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Future Textile Laboratory Practice

By GEO. B. HAVEN, S.B.

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WHILE the determination of the chemical properties of textile fibers has long furnished an acknowledged department for that science, it is only within recent years that the physical properties of textiles have attracted any notice. In a sense, this is natural, since the physical properties are dependent upon the numberless forms in which the fibers are manufactured. Hence the determination of the physical factors in regard to textile products was long considered too confused and diverse to warrant much serious attention.

With the advent of the scientifically built automobile tire, there came a keen demand for standardizations, acceptances and rejections of tire fabrics. This called into action a host of physicists throughout the country, and gave a great impetus to the cause of textile physics. At the same time, an intelligent way of handling the moisture question was devised, and this of itself blotted out numerous difficulties of the past. For a long period, however, the determinations of strength, stretch, thickness and similar properties were considered rather speculative than exact, and frequently caused a disagreement between the factions interested rather than mutual understanding.

In 1913 there was formed a group known as Committee D-13 on textile materials. This apparently insignificant department has continued to grow, as we all know, for the ensuing years until now it constitutes one of the great committees of the parent society.

By means of this committee, there has been a wide adoption of standards and tentative standards, together with the publication of numerous papers bearing upon this comparatively novel department. As at present constituted, the standards of the Society include the measurement of tensile strength, yardage, count, thickness and moisture, together with numerous tolerances. Further than this, the standard specifications have not as yet gone.

It is the object of this paper to suggest certain new avenues along which it is believed the future work of Committee D-13 will doubtless be directed. It is natural, with the almost limitless uses of fabric, that there should be an intelligent determination of practically every physical quality. Some fabrics depend for their value upon openness and porosity, while others depend upon the very reverse. Again, certain types of material should be highly absorbent, while, for yet different purposes, the opposite is desirable.

The following suggestions concern themselves not with the original fibers but with their manufactured forms in yarn and fabrics. Aside from basal research of a very broad character, the study of fibers is outside the reach of the average testing laboratory. The determinations are listed, first, with reference to yarn, and second, to fabric. The yarn properties may be listed as follows:

(a) Measurement of yarn balance
(b) Measurement of corkscrew
(c) Crimp determinations
(d) Yarn slippage

The fabric qualities may further be stated as follows:

(e) Porosity
(f) Absorbability
(g) Bursting strength
(h) Precise thickness
(i) Abrasion
(j) Heat flow
(k) Resilience

Before describing numerous experiments made by the author in the direction of these various properties, it should be stated that one of the great advances in the future textile laboratory will be in the direction of moisture control. The bone dry method of testing, with its evident disadvantages of inaccuracy, haste, etc., has well nigh been superseded by other forms of testing. It is impossible to remove materials from the oven and make careful and precise tests with enough dispatch to prevent a considerable reabsorption of moisture in transit. The figures determined from bone dry tests are only half or two-thirds those of goods conditioned in a standard atmosphere. Therefore, if

the figures have any significance aside from mere comparison, they are altogether too low for such a use. It is rare, if ever, that mechanical fabrics are actually used in a bone dry condition. There is generally present the opportunity for them to partake at least of normal atmospheric conditions.

The method of correction by table or chart from prevailing conditions to those of full regain is open to many criticisms. While it is very desirable to know the full effect of moisture upon any material, it is nevertheless very difficult to secure enough data to properly correct any given material for the moisture present. If fabrics were all of the same character and weave, and were made of but one kind of fiber—and that of a standard maturity and grade—it would be comparatively easy to base a dependable correction for tensile strength upon a plot of the regain strength values. As has been pointed out before, the coefficient of correction varies widely between light yarns and heavy ducks, even when limited to standard grades of cotton. It would seem, therefore, that, after all, the best method of testing, by far, is to properly condition all the material in an atmosphere either precisely or nearly of standard properties.

With the increase in the character and accuracy of moisture apparatus, there have come upon the market many types capable of washing, cooling, dehumidifying, moistening or warming the air. This can be done automatically and at a reasonable expense. The illustration, Fig. 1, shows a new type of standard central station plant which will totally correct the prevalent conditions of the weather to a very accurate standard when desired. The cost of such appa-

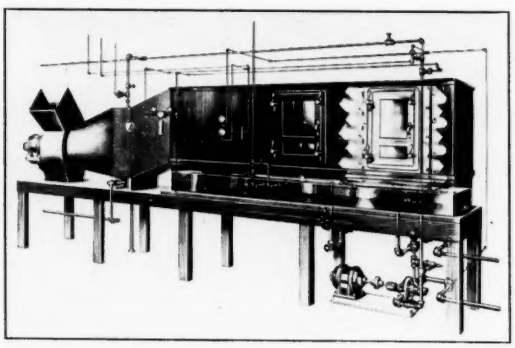


Fig. 1

ratus is much lower than heretofore, and the operation is, similarly, much more prompt and effective.

(a) *Measurement of Yarn Balance.* In the case of plied and cabled yarns, the term "balance" has been applied to the property which such yarns often possess of preserving themselves in their final form without tendency to untwist or kink. This, of course, is accomplished by introducing into the single and ply yarn, and sometimes into the cable, sufficient twist of the correct hand to cause the yarn to hang quiescently in a loop even when the ends of the catenary are brought together. The common and primitive method of measuring balance has been to suspend a loop of yarn about five feet in length between the hands, gradually bringing the same together until the strands touch. If the yarn is in perfect balance, there will be no tendency for it to double, re-twist and kink, but it will lie in a pendent loop, free and without disturbance. Naturally, in very many operations of sewing, knitting, plying and placing such yarns and cables in their final form, this is a very desirable property. The skillful spinner and twister, generally by experi-

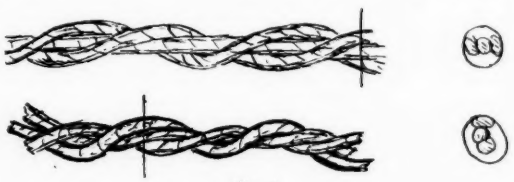


Fig. 2

ment, will introduce just enough twist into the primary yarns so that the ply or cable will be perfectly balanced. The only way in which this determination has ever been made to date is as described above and by stating the yarn "was" or "was not" balanced. This is a poor method, and one causing much dispute. If a yarn is in perfect balance, there will be no tendeny to untwist as it lies in a horizontal neutral position. The measurement of unbalance is therefore simply the measurement of the untwisting torque which exists in the imperfectly plied or cabled yarn. This subject is under investigation in various laboratories and it is believed that soon an electrical method will be devised whereby the tendency to untwist can be accurately measured in such units as ounce-inches of torque. As this quantity approaches zero, the balance of the yarn will be more perfect. Such a quantity would be a valuable indication in setting up the proper amount of twist in a plied or cabled yarn.

(b) *Measurement of Corkscrew.* It is a well-known fact that unless the tension is very carefully adjusted in plying yarns, the respective spirality of the same will not be identical. This means that certain yarns will lie comparatively straight in the ply, while the others are more or less twined about them. This, of course, causes a great loss in the strength of the material. Under tension, the plies will break in succession rather than simultaneously. With careful use of the twister, especially in regard to spools running out together, there is no necessity of a great difference in spirality. In some forms of beam twisters, the traverse of the yarn from the beam to the twisting spindle is so variable that a high degree of stretch is imparted to one ply, while others are comparatively neutral. This produces a condition of corkscrew which is very undesirable. The illustration, Fig. 2, shows how corkscrew may vary from small and hardly discernible amounts to what might be called 100 per cent corkscrew, where one strand is entirely straight

while the others are tendriled about it in such a loose manner as to be of no value for resisting tension.

With the object of measuring scientifically this quantity, the apparatus shown upon the slide, Fig. 3, was devised and used at the Institute laboratory. The head of a twist measurer is mounted upon a large flat board and one end of the ply to be analyzed fixed to it. The other end of the board is mounted with a smooth brass rail which consists of a circular arc about the center of the twisting-head jaw. The strand to be analyzed is hung over this rail and a weight is applied to it, sufficient to keep it taut and uniform. The twisting-head is manipulated to untwist the plies, and needles are used to remove entirely the twists and to

Fig. 3

isolate the plies. Each ply is then hung with a light weight in such a manner as to hang down over a piece of 10th-inch plotting paper. If all the plies were of equal length, namely, if the spirality of them all had been identical, then the weights would all hang upon a horizontal straight line. This is practically never the case. Some of the plies are slightly corkscrew and therefore may be longer than others which are comparatively straight. With each ply suitably weighted, a pencil mark is made on the cross-section paper at the bottom of the pendent weight.

In order to compute mathematically the amount of this corkscrew, the following expedient has been adopted: Taking the highest weight as a zero quantity, the distance of all the other weights below it are read respectively and averaged. The line *cd*, Fig. 4, thus indicates the average position of all the

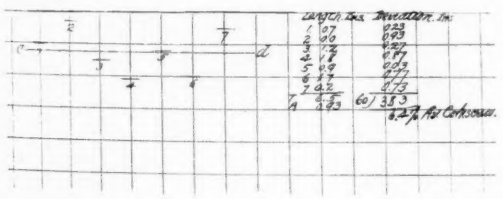


Fig. 4

weights and the extension of the cord upon untwisting if there were no corkscrew. Next, the deviation of each ply from this average is read, recorded and averaged. The average deviation divided by the original length of the cord from the twisting jaw to the rail, 60 inches, is then used as a basis for determining the average per cent of corkscrew.

(c) *Crimp Determination.* The question of crimp or sinuosity of yarns in fabrics has long been one of great interest. This was especially true when square-woven fabric was the ideal material for automobile tires. Although this time has passed, there are still very many fabric uses where, without doubt, less off-square would be a very valuable factor. The ordinary methods of measuring crimp are well known, but they are, withal, cumbersome and slow. They involve the use of weighted devices, Fig. 5, so applied as to straighten out the woven yarn after raveling, but not to stretch it. The original work on this class of test was performed by Mr. E. D. Walen, at that time Chief of the Textile Section of the Bureau of Standards, Washington, D. C. Most present-day equipped ma-

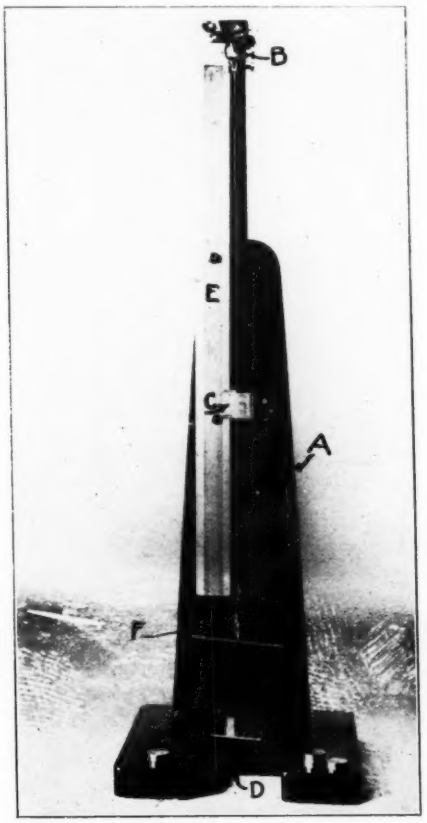


Fig. 5

chines are adaptable to but one fabric as, for instance, heavy canvas. None of them are accurately of use for fabrics in general, and to our knowledge a recording crimp tester has not yet been successfully manufactured. The sketch upon the screen, Fig. 6, shows a proposed autographic crimp tester which is at present under consideration at the Institute laboratory. A very light balance arm of duralumin is supported up-

on a knife edge. Equally spaced from the knife edge are two hanging chains, each attached to a chain sprocket. These chains are very accurately of the same weight per foot, and are unwound from the sprockets by the action of a pendent weight and double

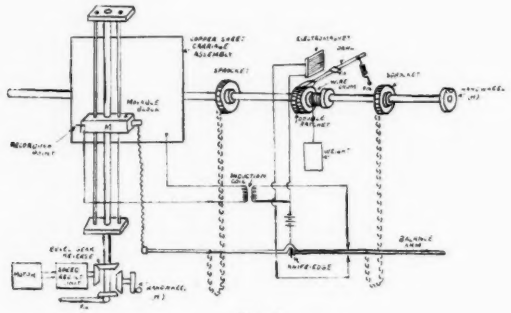


Fig. 6

tooth ratchet. The ratchet is released slowly and uniformly by the action of an electro-magnet. The upper end of the yarn in which the crimp is to be measured is clamped to a block which is elevated at a constant rate by a revolving screw. The bottom end of the yarn is clamped to the left end of the balance arm. The loads corresponding to the different elongations are then determined by this balance arm, the principle being that of differential chainomatic loading. Whenever the equilibrium of the balance arm is disturbed by the force which is constantly stretching the yarn, a make-and-break electrical circuit allows more chain

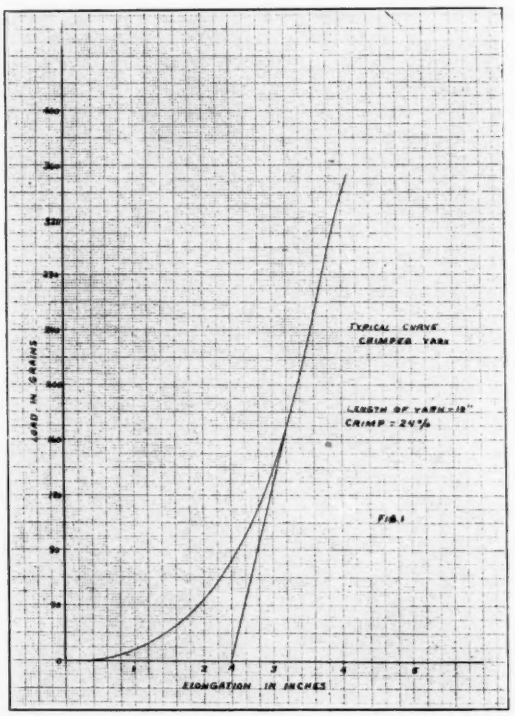


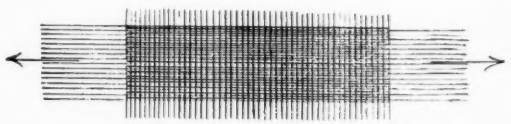
Fig. 7

to be suspended on each end of the balance arm, but at different rates. The chain on the left-hand side is released at a faster rate than on the right. By this means a chainomatic differential is obtained which is highly desirable and sensitive in testing very light yarns such as rayons.

An electric spark recorder is used to obtain a record of the loads and corresponding stretches with as little friction as possible. A chart can thus be drawn of the typical crimp type, and this chart may be measured directly for any fabric whatever, just as readily as a stretch chart may be measured upon a tension machine. Fig. 7 shows a typical chart with the simple calculation necessary to measure the crimp. By using suitable chart paper, the crimp may be read directly upon a gauge length of yarn of ten inches. The crimp is here 24 per cent. It is believed that an instrument of this type would be of great use in many fabrics for resisting pressure, for it is in such that the variation of crimp or the off-square of the fabric is of the greatest importance.

(d) *Yarn Slippage.* Certain fabrics depend for their excellence upon their integrity of position in the warp and filling yarns. This is essentially true of gauzes, nettings, marquisettes and open fabrics of such types. Of course, when the fabric is very open, such as a coarse netting, it is necessary to use a leno weave, whereby the warp and filling threads are virtually tied at every intersection and no displacement can thereafter take place. This is expensive and sometimes impossible. Hence very many such materials, especially of the cheaper grades, are simply given a square weave, and friction between the warp and filling is assumed to be sufficient to keep the threads in their correct places. This is especially difficult to obtain in fabrics of silk or rayon, where the goods are of a soft slippery nature.

The question often arises—How can the resistance to yarn slippage be measured in fabrics? This has been attempted in the Institute laboratory by the use of an ordinary vertical fabric-testing machine and stretch recorder, but with the sample prepared in a



Yarn Slippage Specimen

Fig. 8

novel manner. Let it be assumed that the slippage of the warp threads through the filling is desired. An ordinary warp strip sample, Fig. 8, one inch wide is prepared and raveled as usual. The filling is also raveled down into the strip sample to a distance of at least one inch. In raveling the filling, a fine needle is inserted along one filling thread, which separates

all the up-and-down warp threads for that pick of the loom. The up threads are cut off, thus leaving one-half the warp threads undisturbed. At the other end of the sample, the same process is carried out, being careful to cut off the warp threads corresponding to those which were not cut at the top of the sample. This leaves a strip sample with raveled ends at top and bottom, the body of the goods being made up of threads interlaced for three inches, but cut off before clamping into the jaw. Such a sample is tested in the ordinary machine, as if for strength. The yarns slip by one another and the reading of the machine dial is simply the force necessary to produce yarn slippage in a length of three inches and a width of one inch. The stretch chart, Fig. 9, drawn for such a specimen is of the type shown upon the screen, and consists of a portion *ab* indicating the increase of the load before slippage takes place, a point *b* where the

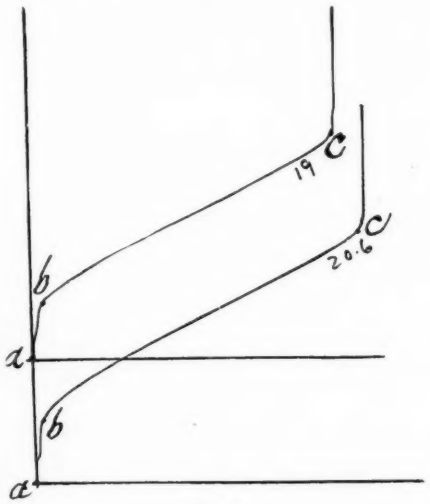


Fig. 9

slippage begins, a portion *bc* where the slippage is progressing, and, lastly, a point *c* where the entire dissociation of the threads takes place. Such a diagram presents large possibilities for the study of loom tensions, friction of yarn and general liability of threads in the fabric to be displaced.

The properties of fabrics should be investigated as thoroughly and broadly as those of yarns. The use to which a fabric is ultimately put has much to do with the form of test used to determine its acceptance. The porosity or openness of a piece of material is often of considerable importance. Thus, in filter cloths and insulating felts, the presence of open pores in the cloth should be controlled and their effectiveness in permitting the passage of water or air should be demonstrated and measured.

(e) *Porosity.* The accompanying slide, Fig. 10, illustrates a machine designed and built by the speaker for measuring the porosity in papermakers' felts. It was found experimentally undesirable to use water or

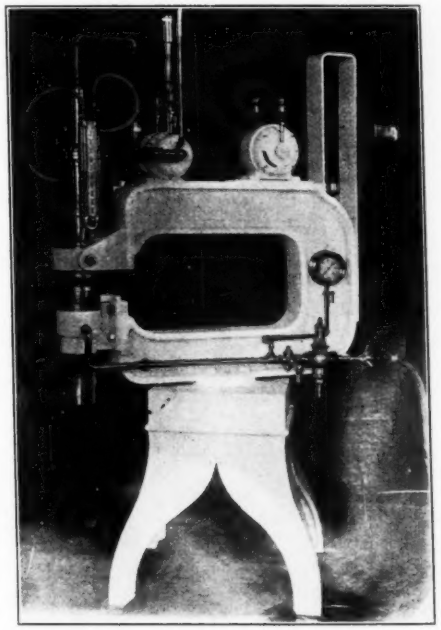


Fig. 10

other liquids to establish the porosity of a given fabric, since a stain was produced upon the fabric. By a series of careful experiments, atmospheric air was found to be as effective as a liquid in establishing the degree of porosity of a fabric. Therefore the accompanying porosity machine is simply a U-shaped frame between the arms of which the fabric to be tested can be securely clamped. All the bearings are of a trunnion character so that the fabric is not injured or gripped unevenly. Upon the top of the machine is mounted a low-pressure air blower, together with the necessary screens and reducing valves to secure clean air at any desired pressure. This current of air is passed through an orifice tube, so that the amount of air passing through the fabric can be measured. A U-tube is employed to secure a uniform difference of pressure before and after the orifice plate. The resistance of the fabric to the air flow causes a definite back-pressure to be built up. This back-pressure is recorded upon a Bristol gauge and is a measure of the porosity or density of the fabric, as the case might be.

This machine has been used for a wide variety of fabrics, ranging from thin felts to heavy insulating jackets. By this means, the porosity of two fabrics can be compared, and fabrics may be designed to secure a given degree of porosity.

Certain fabrics are designed to be highly absorbent, taking up water and other liquids with avidity. The measurement of absorbability is divided into two classes: (a) total capacity, and (b) rate of absorption.

(f) *Absorbability.* The total capacity of fabrics is easily measured by immersion for a definite time in the liquid under question at a given temperature. The

(Continued on page 782)

A Vapor Method for Removing Grease, Oil and Wax

By William J. Miskella

FEW of us have thought about the use of other than liquid solvents for removing grease and oil. However, a new machine is being introduced in the metal industry for this purpose and it is perfectly evident that the same idea has application in other fields as well. The use of certain chlorinated solvents for the removal of grease has long been known to be effective, but it has not been very widely introduced into industry.

Under the new plan, the solvents are boiled at the bottom of a tank and vaporized. The vapor rises in the tank (Figure 1) just to the level of the water-cooled condenser that is provided, and returns to the tank upon condensing. The vapor is more than three times the density of air and has no tendency to overflow.

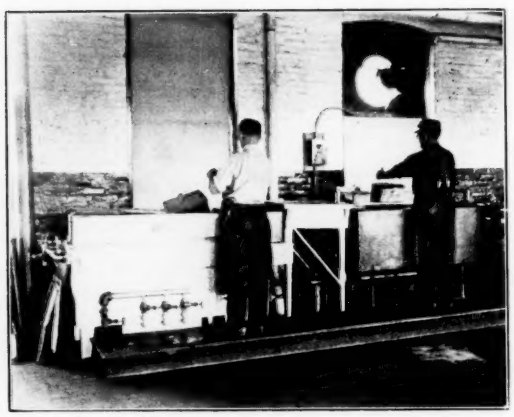


Fig. 1
Vapor Cleaning Process Used in Cleaning Parts for Silver Plating.

Whatever is to be cleaned is simply suspended in the vapor in the tank (Figure 1) and if it will permit the vapor to condense, the grease or oil will be carried down into the liquid below. The parts reach the temperature of the vapor, depending upon the weight and gauge of the metal or whatever the material is that is being processed. A few seconds or a few minutes' exposure in the vapor will cause the article to become perfectly dry and greaseless.

Some of the items capable of being cleaned in this process are metals, glass, bakelite, celluloid, leather, brake bands and so on. Wax will also be removed from any of these surfaces by the same process.

After the cleaning action in the tank has been completed and the parts have been removed from the tank, there will be a slight dust deposit remaining on the surface due to insoluble portions of the oil or grease or dirt originally on the surface. The oil is removed by the vapor solvent action and the dirt is removed to a certain extent by the slushing action of the condensation.

No metal will be rusted, stained, or tarnished by this process if moisture is absent from the liquid in the tank or the surface of the article is not wet to begin with. The liquid and the vapor are non-inflammable and non-explosive. There is a slight odor, but it is no more objectionable than the smell of gasoline in the room.

The process has an application in the textile mill in cleaning heddles, harness reeds and spools to prevent their staining the fabric.

One kind of liquid chlorinated solvent weighs 12.2 pounds per gallon and boils at 188 degrees F. while the other weighs 13.4 pounds per gallon and boils at 246 degrees F. It is claimed that an average of 750 pounds of metal parts can be cleaned per hour at a cost of approximately $.40 which covers fuel and chemicals.

Water is used in the condensing coils to prevent the vapor from arising above the slots in the tank, to maintain a definite level, to provide a means for distilling the solvents from the residual grease, etc. The equipment needed consists of a special tank which may be heated by gas, electricity or steam.

Publication of Committee D-13, American Society For Testing Materials

The American Society for Testing Materials, through its Committee D-13 on Textile Materials, has recently published a pamphlet which embodies specifications covering a wide range of textile materials. It contains Tolerances and Test Methods for Cotton Yarn and Sewing Threads, Light and Medium Weight Cotton Fabrics, Tire Fabrics and Tire Cord, Electrical Silk and Cotton Tapes, Asbestos Yarn and Tape, Rayon, Knit Goods; Tolerance for Numbered Cotton Duck, Hose and Belt Ducks, Tire Cord; Methods of Testing Woven Fabrics; Specifications for Testing Machines, Chafer Tire Fabrics, Cement Sacks, Sugar Bags; and Definitions of Terms Relating to Textile Materials.

These specifications have been developed by the collaboration of Producers and Consumers of textile materials, assisted by representatives of Government Bureaus, Testing Laboratories, and manufacturers of testing equipment. They represent best methods known at present and are revised from time to time as knowledge of textile materials advances.

Committee D-13, made up of Consumers, Producers, and General Interests, is in a position to develop specifications acceptable to all interests concerned. Its specifications are used generally and are accepted as standard. They furnish a common basis for comparison of materials which is a decided advantage to both Consumer and Producer.

The Committee is actively engaged along the above lines and expects soon to include wool and worsted, silk and jute materials in its work. Price 80c.

Proceedings of the American Association of Textile Chemists and Colorists

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MEETING OF NORTHERN NEW ENGLAND SECTION

The Northern New England Section met at Riverbank Court Hotel, Cambridge, on Saturday evening, November eight. Forty-four were present at dinner, and about fifty at the meeting.

Dr. Donald H. Powers of the United States Finishing Co. spoke on "Textile Research," and Hugh Christison on "Washing Fastness Tests."

Walter H. Zillessen was elected a member of the Sectional Committee.

The next meeting was arranged for January tenth, with William H. Cady and Harry R. Davies as speakers.

Respectfully submitted,

Harold C. Chapin,
Secretary.

The Use of Standardized Colors

By A. Maerz

THE enormous extent of industry and commerce today is one of the phenomena of history. Granting that a major factor in its causes is the tremendous population of the present world, together with the spread of knowledge and culture through all the classes due to democratic ideas and the no less universal efficiency in organization, it is none the less true that a large measure of this great commerce is due to color. In order to realize this, one has only to consider what a part color plays today in all fields of life. To come straight to the point wherein the textile man is affected, consider what the textile business would be if all color were removed. The entire dye manufacturing industry would be eliminated, so would the dyers and printers, the engravers and designers. In such a case, all that would be left would be weaving and finishing, and in the matter of costume, fashion would concern itself with lines alone. Competition between manufacturers, and the sale of goods, would both have to be conducted along different lines, since both are largely based, under existing conditions, upon colors, either solid or in pattern. The textile business would be a relatively simple affair, and while it would still require textile chemists, there would be no need for textile colorists.

So color is a matter of very vital interest. And since the rediscovery of the fact of bright color about five years ago, it has become to many manufacturers a matter

of very anxious interest. Today everything must be colored, from furnaces to table-cloths, from locomotives to street-pavements, from toothpicks to toilet-paper. All that would not be so bad. The gaiety of life today, at least in its material aspects, is something to be thankful for; contrast, for example, a beach scene of today with what we used to see at the beginning of the century; the gorgeous effect of a modern sea-beach, with the glowing colors of swimming-suits, sun-shades, and beach-robes, is a never-ending source of delight.

But along with this growth of the use of brilliant color, there has been a widespread process of education in the so-called harmony of color. Books, articles in periodicals and women's magazines, radio talks, and advertising literature, all dealing with the subject of color harmony in various degrees of detail, are of frequent and regular occurrence. And that has caused no end of trouble for manufacturers.

In the Magazine of Business for September, 1928, there appeared an article by Herbert C. Hall, entitled "Color—Is It a Fad?" which gives a clear picture of this situation.

The author said: "The development in the use of color seems to have resulted in a regular spree, bringing unlooked for manufacturing difficulties in certain lines of industry. In any case, what looked like a pretty sales proposition brought untold difficulties in production and distribution."

He then quoted a statement by a prominent manufacturer of high-class stoves, as follows: "Color is proving a nightmare with us. We have become involved in tremendous manufacturing costs that we could not possibly have included in our original estimate, when we decided to bow to what we thought was the popular demand for our product in color.

"And we can never expect to recover. The public—I am now speaking about the majority of consumer prospects—admires our product in color, yes; but when it finds the cost to be somewhat higher than our plain ranges in black-and-white, or black-and-grey, it invariably buys the plain ones. And yet, color is just enough in demand to make it necessary for us to continue it.

"White or grey opaque that is so commonly used in our white or grey enamel backs, legs, and bases, costs 50 cents a pound. Certain colored opaques which are necessary to obtain a range of colors in our enamels cost from $4 to $6 a pound. This brings the cost of our colored ranges up more than 15 per cent—oftentimes as high as 25 per cent.

"We must also include in that increased cost our increased production costs. Production is slowed down considerably by color. We are dealing with an uncertain element in colored enamels. We may be able to get a delicate blue today—tomorrow, in trying to mix the same color, we get a harsher blue. Hours are spent in trying to get as nearly a perfect match as possible, for it would not do to have different shades of the same color on display on a dealer's floor.

"Distribution also suffers. Certain colors may prove popular in certain localities; other colors, in other localities. We have found it necessary to incur tremendously heavy traffic costs in switching our ranges around from one dealer in one town to another in a distant one. Blue may now be popular in Chicago, and green in New York. Ivory may sell more rapidly in Detroit, and olive in Pittsburg. It costs thousands of dollars to determine this, and tomorrow it may all be changed.

"There has not been any move that we know of on the part of range and furnace manufacturers—yes, eventually, I am afraid that we will have to get into the manufacture of furnaces in color—to standardize on colors. We are seriously thinking of taking the initiative to see if this cannot be done. I should say that standardization on three colors would prove to be the most practical.

"Unless something is done, and done quickly, I fear for the health of our industry. Manufacturers are bringing color abuses upon themselves. I do not believe that color is exactly a fad, but I also do not believe that we will continue to have such a wide range of choice. Business cannot stand it, that is all."

This poor fellow was certainly in a sad state. Of course, in his case, color was something entirely new, and undoubtedly much of his trouble was due to that newness. I will quote further from the same article:

"Color has not yet been organized, and it is doubtful if it can be, unless or until there can be arranged a meeting of minds on the part of the majority. There is as yet no general movement on the part of manufacturers to standardize on colors, and yet, the vital need for such a movement has been recognized.

"Take, for example, the Evanston, Illinois, society matron, who desired to have her kitchen appointed in Robin's Egg Blue. She went to a considerable expense in having imported Dutch ceramic tile set-in in her walls. She was able to get the proper shade of floor-covering without much difficulty. But the best she could do in a kitchen cabinet and tables and chairs to match was an off-shade blue. She reported that the plumbing fixtures were "an impossible blue which did not at all fit in with my color scheme." And the gas-range was still another shade. She gave up her idea when she found that it was utterly impossible to get cooking utensils to match the blue she so much wanted.

"This woman, being quite wealthy as well as prominent, kept several manufacturers on the jump trying to satisfy her color whims. One manufacturer complained that she had thrown production in his plant off for nearly a week, and that he could not possibly hope to recover his loss."

Here we have an illustration of the trouble caused by this craze for color harmony. The room described is the lady's kitchen, but undoubtedly she had the same trouble with her living-room, and gave dealers in textiles as much, or more, trouble in trying to satisfy her ideas of color schemes. The example is an extreme one, due to the woman's command of money, but to a lesser degree, the same trouble exists today all over and in all industries using color.

The problems concerning color, for which standardization is looked upon as offering a solution, are various, and it is necessary to understand the exact difficulty in any particular problem if standardization is to be of any help. In the case of the lady and the kitchen, I am quite sure that all the manufacturers she called upon told her: "Oh yes, we have what you want in Robin's Egg Blue." But when the colors were compared, every single article was of a different shade, as we were told. That is a situation that has been so common and so well known, that to mention it has now become trite. And there was probably at least one manufacturer, who had exactly the color she wanted, but who said to her: "I am sorry, we do not make the article in Robin's Egg Blue, but we have it in a lovely Nile Blue." And because his name Nile Blue was not her name Robin's Egg Blue, she would not look at it. Along other lines, the cost of textile printing must frequently be considerably more than it need be, because designers make use of a myriad of hues, changing them constantly in the endeavor to be "different," and demand that the textile printer match them exactly. I will discuss this particular problem in more detail later.

It might seem to be explaining the obvious to say that it is necessary to understand the exact difficulty in any special problem, yet it is astonishing how few even of those whose business includes color actually do understand. I have been called into consultation by firms who could not even formulate their own problems. Take the example of the manufacturer of ranges, which I have quoted. This man had not the slightest conception of his problem, nor did he realize that he was deliberately causing his own trouble. He says himself that he finds it difficult to produce always the same shade of blue, and that hours are spent trying to match a certain shade. But the whole point here is, why try to obtain always the same shade, why limit yourself to one shade of a color? People do not buy ranges every week, nor every year. When they buy new gas-ranges, it is with the expectation that they need not be replaced for several years. Nor do you ever find two ranges in the same kitchen. It is therefore absolutely unnecessary that any two ranges should match in color. This manufacturer's statement that it would not do to have different shades of the same color on display on a dealer's floor is simply ridiculous, and shows that the man's ideas are based upon a completely erroneous business philosophy.

Suppose a woman enters a store to buy a blue gas-range, and finds them all exactly the same shade. The dealer tells her with great pride: "Yes, madame, our company goes to great expense to maintain always this same shade of blue." But there are a thousand chances to one that his blue does not suit her, and she walks out. But if she can go across the street and enter a store where a dozen different shades of blue are on display, she is almost sure to find one that will suit, and this store makes the sale. A store is not a place for the display of an object-lesson in color harmony, nor of the manufacturer's ability, at however great expense, to maintain always the same shades of color, but for the display of a group of articles from which a customer may make his selection. We have a positive proof of this in the story of the Evanston matron and her kitchen. If our range manufacturer had let his raw material produce his blue enamel in a variety of shades, instead of spending so much time in forcing it to one particular shade, which was originally selected, mind you, either because he happened to like it himself, or because it happened to be the first shade which his color-mixer got out, it is extremely likely that the lady could have found a shade to suit her color scheme.

It may seem that in making these few remarks about the range business, I am straying from the field of textile color problems, but I am keeping that subject constantly in mind. Color in the textile business is very old, and you are all acquainted with its special color problems. It is well to know also that these problems are occupying the attention of other industries in which color is new. It is necessary to realize that if the standardization of color is to be of benefit to any one industry, it must be a standardization that is accepted and maintained by all industries, and by the arts and sciences as well. If a society matron wishes to decorate her kitchen in Robin's Egg Blue, she must find that Robin's Egg Blue means the same thing to the makers of gas-ranges and kitchen cabinets, ceramic tiles and floor-coverings, as well as to the maker of the textiles that she uses for towelling and draping the windows.

When these problems arise, especially in those industries in which color is new, but sometimes also in those in which it is old, as in the textile business, it is found that sooner or later the idea of color standardization is grasped at, one might almost say despairingly, as in the two instances I have quoted, but always vaguely as a sort of cure-all.

The idea of color standardization is not exactly new; at the same time, it is not very old. About 150 years ago, it seems to have been first discovered that colors could be classified in a practical manner. From that time, when Lambert in 1772 made an arrangement of colors in

pyramid form, which Ostwald has revived today in his system, down through Chevreul, the most famous of colorists, there appeared a succession of such systems, culminating today in the splendid Munsell Book of Color, which is the last word in technical classification and beauty of presentation. Systems such as these refer to their colors by numerical symbols, of slightly varying arrangement, and do not include any names of colors.

The first attempt to supply a standardization of colors to which names were attached as a uniform nomenclature, was a book published by Patrick Syme, in 1814, which made use of a system devised by a great German scientist, A. G. Werner. Werner, for his own use in describing and classifying minerals, arranged a set of actual pieces of minerals as color samples, for which he drew up a list of convenient names. Syme made up a book on the idea, reproducing the colors carefully, for the benefit of other scientists. Practically all the names in this work are among the standard color names of today. To give, however, any kind of an idea of the history of this special topic, in either of the two branches mentioned, would occupy an entire evening. I have covered the subject pretty fully in our Dictionary of Color, to which I would refer you.

Now, when color problems are encountered and the idea of color standardization is brought forward by those who are unacquainted with the subject, it is probably quite natural that they should believe that the making of such a standard ought to be a simple matter, and that a scientist, upon examining the scientific facts of color, ought to find ready to his hand a scale of colors of scientific exactitude. But, on the contrary, it is found that the technical difficulties involved are so great, that even after we have produced a scientific method of measuring color, the method is one which is only available for the laboratory. Not only this, but even in laboratory work, the special character of color is such that the instruments used for measuring are required to be of extraordinary precision and delicacy, so that any two of them, unless they are calibrated together, are very likely to give different readings.

Color, as you all know, has no objective existence. It depends entirely upon the condition of the eye which perceives it, and on the character of the light in which it is seen. The totally color-blind eye sees no color at all, but only a scale of greys. The partially color-blind eye sees a few colors, but greys in the place of others. The factors of simultaneous contrast and after-image or residual color on the retina of the eye affect the apparent color of an article to a surprising degree. So that we start with an organ for the perception of color, which itself is actually able to alter the color which arrives at it.

The very fact that an object is seen indicates that some kind of light is falling upon it, either natural or artificial. Direct sunlight is distinctly yellowish in tone. Light coming from a direction away from the sun, such as the northern sky into a place shaded from the direct sun, lacks this yellowish tone, and has become the standard medium in which to judge colors. Some authorities claim that this northern skylight is not truly white, but is simply what is left of true white, after the yellow component of direct sunlight is subtracted. In other words, we have not even been given by nature a source of light which we can definitely prove and demonstrate to be truly white, that is, colorless.

Let us disregard the vagaries of the eye, and let us assume northern noon skylight to be white, or colorless. When we speak of such a light as being colorless, we are more or less uttering a paradox, because an absolute absence of color would strictly produce total darkness. What actually occurs is a combination of a number of colors in such proper proportions that the unified effect produced on the mind is what we speak of as being white, or colorless. This range of colors can be spread apart and made separately visible by a prism, when it is called a spectrum, where, as all know, the colors arrange themselves in the order Red, Orange, Yellow, Green, Blue, and Violet. Color, in its transmission through space, is nothing more or less than vibration, the nature of which is not yet exactly understood.

As vibrations, colors can be measured, either in terms of time, when they are called frequencies; or in terms of space, when they are called wave-lengths. The latter is the more usual, and the unit of measurement is the Angstrom Unit, which is the one ten-millionth part of a millimeter, and refers to colors by numerical expressions of four digits. Sometimes a slightly less precise unit, the one-millionth of a millimeter, called a millimicron, is found more convenient; this refers to colors by figures of three digits.

When a spectrum is observed in a spectroscope, certain lines crossing it appear. A few of these of special distinctness were long ago chosen as reference marks and given the letter from A to K to distinguish them. The wave-length of the vibration of light at any point in the spectrum can be measured with great exactness, and it is found that in the Red at Line A, this wave-length is 7594 A. U., and that in the Violet at Line K, the wave-length is 3934 A. U. Thus if we made use of the spectrum as a natural scale, there would be a sufficient range of colors for all practical purposes, since there would be between these two points 3660 wave-lengths or steps in our scale. But the beginning and end of this scale, being numbered 3934 and 7594, are certainly rather queer terms for an orderly scale, and it has therefore been suggested more than once that a decimal division could be applied to the spectrum. Ogden N. Rood, who was professor of

physics at Columbia, in his book "Modern Chromatics," published in 1879, divided the spectrum into one thousand parts, calling Line A in the red "zero," and Line H in the Violet at 3969 A. U., "One Thousand." He chose Line H as the end of his scale, instead of Line K, because the spectrum at Line K is faint and the colors almost impossible to match. Thus you see that any application of an orderly scale to the spectrum is bound to be a purely personal matter. Rood called his one thousand division the Normal Spectrum, and so far as an orderly division of the spectrum is concerned, it is as good as can be devised. But while it has been referred to in a few other books, I have not found that it was ever used by anyone other than Rood. And when we consider that the authority of Professor Rood and the great popularity of his book Modern Chromatics were not able to get his thousand step spectrum scale into use, it is evident that any such scale is not found suited to practical requirements.

In the meantime, for laboratory use, the regular wave-length division of the spectrum came to be completely established, and while in the laboratory, for purely technical work, that system is quite satisfactory and exact, in practical everyday life it would not serve at all. A certain red shade in the Dictionary of Color might be referred to in Angstrom Units as Red 6302, or in millimicrons as Red 630, as simply as wave-length 630, which as a matter of fact would be the term used. But ever since colors were first referred to in human language, they have been spoken of by names, and that habit is so completely ingrained in human consciousness, that it would be absolutely impossible to change it. To speak of Red 630 might have certain advantages, if all the world could be induced to use that expression, but it happens that the particular shade in question is known as "Scarlet," and the world will continue to call it Scarlet, and not Red 630.

So far, we have mentioned only the one attribute of color which concerns Hue, that characteristic by which Red differs from Blue, or Yellow. But colors have three attributes, or ways in which they can differ, the other two being the Attribute of Value, by which they differ in being light or dark, and the Attribute of Purity, by which they differ in being pure or greyed. And while it might be possible to accept the wave-length scale of Angstrom Units or Millimicrons as a natural scale by which a standardization could automatically be derived, the other two attributes offer great difficulties in practical use. They might be considered as percentage components of white and black, as in the Maxwell Disk device, or as percentage reflections or transmissions, as in spectroscope work. But such work is suitable only in the laboratory, and is utterly impossible in practical commercial life.

It is for this reason that the various systems devised in the past which have referred to colors by numerical terms have never gained popular recognition or extended use, so far as concerns the standardization of nomenclature. Everyone of these systems has been worthy in itself, but the numerical terms by which they referred to their colors are terms which no effort of the imagination can conceive of as being possible in literary use for description, or in commercial use as names for textile fabrics.

The consequence of this is, that if standardization of color is to be arrived at, it must begin with color names. If the world insists upon using such terms as Robin's Egg Blue or Scarlet, it would seem that the only possible basis of standardization is to establish a definite specific shade for each name, for which permanent samples might be distributed, without regard to the physical or optical make-up of that color.

Such systems have been issued, and two of them have received wide recognition. One is Ridgway's splendid work, "Color Standards and Color Nomenclature," used mainly in the biological sciences, in ornithology, mammology, etc. The other is represented by the Cards of the Textile Color Card Association of the United States, which are used in the textile and related industries. The other industries have long been talking about standardization, but, so far, have not produced any. There are a few other systems, such as the great French work, the Réprétoire de Couleurs, which have been published though not made much use of, but which must be taken into consideration when a universal and final standardization of color is undertaken. I have discussed these pretty fully in the Dictionary of Color. In all these systems, however, it is an unfortunate fact that few colors shown under the same names agree.

The reason for this disagreement are many and diverse, and to enter into them here would not be possible. They have been described in considerable detail in the Dictionary of Color, to which I must refer you. It must suffice at this moment to say that the Dictionary of Color attempts to reconcile all such differences, and where a choice of one color in preference to that of another system has been made, the Dictionary points out why such a choice is the logical one. The work includes all the colors of the Textile Color Card Association, up to the time when the book went to press, all the colors in the Ridgway book, with the exception of a certain few, excluded for reasons stated, and in fact, every color name which it has been possible to discover recorded, going back to the beginning of the English language, and including all the foreign names which have become naturalized in English. In all but a few cases, it has been possible to give exact matches.

The Dictionary of Color makes no pretence of being a new system. Its sole purpose is to produce the colors

in such a way as to provide as many different colors as possible. Naturally in order to do this, some system had to be made use of, and the method used could, of course, be used as a system of color. But no attention has been paid to this point, and the book is intended to provide a complete list of color names, with a complete range of permanent colors.

As to the permanency of the actual inks used in printing the Plates, I would point out that they are all new pigments, made under my direction especially for this work. They are coal-tar lakes, and are very permanent. The printed plates were tested by exposure to direct outdoor sunlight for days and weeks, and were also tested under the ultra-violet lamp in the laboratory, and they all stood up without fading. In fact, under the ultra-violet lamp, some of the sheets were exposed until the margin of the paper turned a deep yellow, but the colors remains unchanged and protected the white paper underneath.

I could go on to describe to you the method by which the Plates were printed, the exact optical differences that exist between the various steps of colors and of the greys that are used, and so on. It might be interesting to hear that in the preparation of the copy for the reproduction of the color-printing plates, which are simply halftone plates, the range of steps was made photographically, in the Eastman Kodak Research Laboratory in Rochester, by a complicated process which produced to exactness a percentage reflection scale of steps which I had previously worked out mathematically.

But I prefer to consider the book at this time as simply a collection of colors, to which names are attached, since I have attempted to show that only such a basis of standardization, and not one founded upon a system, can be of real service in practical life.

The first thing that will strike the attention, upon examination of any plate, will be that the color names collect themselves in groups, leaving in many cases whole spaces of colors un-named. In fact, the Plates actually represent, in graphic form, a history of the practise of color naming. On the Plates, only the names in current use are printed, all the obsolete and out of date names being listed only in the Index. It might be thought that among these obsolete names would be many that would fill up those blank spaces. But if you will study them, you will find that almost all of the obsolete names fall in the groups which are most named today. Every year there is a splurge of advertising about the new colors, but the Dictionary proves that they are new in name only, in most cases. Year after year, we have the same old browns, for instance, the ugliest color, and the most trying to one's complexion that can be worn. A color that had a tremendous popularity at one time was called "Paris Mud." Can you imagine anyone wishing to wear a costume the color of mud, whether the mud of Paris or any other place, when so many beautiful colors are available? And these browns still continue; the prediction for the current season from Paris is that brown is to be fashionable.

In part, this tendency is due to lack of originality both on the side of manufacturers and users. But in part also, it is undoubtedly due to the fact that there has not existed before a collection of all the named colors thus grouped. If the Dictionary of Color accomplished no other result, it ought to be welcomed by manufacturers and dealers as a tool that will enable them to choose colors that are really new. These Plates are also of very great value in showing how the colors represented under the various names differ among themselves; if a color is sought that differs in a certain required direction from a given one, a situation that frequently arises, that color can be instantly found by reference to the Dictionary of Color.

But granting that a tool be never so perfect, it avails little to produce it, if it is not made use of. Those industries using color, which have expressed a recognition of the urgent need of standardization, and which often allude to standardization as a remedy for their problems and difficulties, will have only themselves to thank for the continuation of their difficulties, if they refrain from using the remedy, now available in the Dictionary of Color. If that book be examined, it will be readily apparent that on the part of its authors, it represents many years of study of every aspect of the subject in half a dozen languages, and on the part of the publishers, it required an investment of money infinitely beyond the possibilities of any trade organization which might contemplate the issuance of a set of color standards. Every source of information written during the past 2700 years has been exhausted, and no labor, and no expenditure of money could go beyond what is here gathered.

So far as its sale is concerned, I might say that the response has been remarkable, not only in this country but abroad. And in the published reviews in trade journals, the kind way in which it has been received has been gratifying in the extreme. Those things, of course, are pleasant, both to authors and publishers. But what the work was undertaken for, and what we most desire is, that it be made use of. If it were purchased, admired, and set on the top shelf, it would have failed in its purpose, which is to furnish a set of permanent samples of colors, a complete list of color names, and to reconcile certain conflicting usages in the application of names to colors; and in the organization of this material, to present a standardization which may be useful and beneficial to all industries and sciences and arts.

The standardization of color may be looked at from three different viewpoints. First, as regards the selec-

tion of a number of specific colors in the abstract, without concern as to their names. Second, as regards the selection of a uniform nomenclature, a set of standard names by which common colors may be referred to. Third, as regards the application of such a uniform nomenclature to specific colors.

Color problems are sometimes—not often, perhaps—easy; and sometimes complicated and obscure. The case of the lady and her Robin's Egg Blue kitchen was one that was of very frequent occurrence in the past, and will continue in the future, until the Dictionary of Color comes into universal use, if it does. That difficulty had two causes. One was the existence of two separate and disagreeing standards, the Textile Color Cards and the Ridgway system. In the paint and lacquer and related industries, as well as in other lines, some firms used the Textile Color Cards, some used Ridgway as their source of colors and names, and the colors under any given name frequently differed. The other cause was that some firms, seeing this difference, rejected both sources and used their own opinion as to what the color under any given name should be. Along with this should be included those individuals who, strange, as it may seem, are actually ignorant of either Ridgway or the Textile Color Card Association, and hence are forced to choose their own colors.

Perhaps I should add a third cause, since there are even firms who, indifferent to the benefits of a common standard, refuse to conform the goods to any standard, using the cheapest coloring matters and the cheapest possible methods of production, but making use of popular color names. There are certain firms of this kind, which are energetic in selling, and which have wide distribution for their wares, with unfortunate results for the cause of color standardization. However, such firms will in time be forced by business circumstances to fall in line with standardization.

Back beyond all causes, we come finally to the one elemental cause that underlies all difficulties, and that is the huge number of colors that exist. The human eye is capable of distinguishing probably half a million different colors. Certainly the number is very great, and even if there were only ten thousand, that number would still be enough to account for all our trials.

The textile industry has long been a battleground of colors. Manufacturers have risen to fame and fortune on the success of a single color. Others have gone into bankruptcy on the overstock of a color that they thought would sell. We say Fashion dictates the use of color, and to a certain extent, Fashion is followed—after it gets into operation. But no action is possible without a cause. I mean this to be taken literally and in an absolute sense. Without cause, there can be no existence. That is a philosophical truism that needs no demonstration. Sometimes actions can be traced to their causes, and so understood. In other cases, their causes are so hidden by circumstance that they cannot be traced. In such an event, we are forced, as for example, in the case of the popularity of certain textile colors, to attribute them to the caprice of Fashion.

One night, a hundred years or so ago, Mlle. Mars, the most famous actress of her day, appeared on the stage in Paris in a striking gown of yellow velvet. The popularity of this actress was such that everything she wore was a subject for discussion by the ladies, and her yellow gown became the rage. It happened that only one manufacturer could supply the color, and he made a fortune. The fact of the matter is, that on a previous performance in Lyons, this actress had been visited by the manufacturer, who induced her to wear the yellow color. He had planned the whole thing and was prepared with his stock. Now one might say that the success of the scheme depended upon whether the yellow color would catch on or not, and that if it had not, the manufacturer would have been sunk. But had there been no manufacturer to concoct the scheme, there would have been no yellow color either. And the point is, that his judgment had been correct that the popularity of the actress was strong enough to create the fashion in yellow.

I suppose there can be hardly a doubt that behind all changes of fashion, in color as in design, there exists the purely commercial intention of causing the purchase of new material each season. In my opinion, that intention is a perfectly legitimate one. With the exception of a very few favored individuals, most people have to engage in business in this life, and without commerce, the world could not exist. Mills have to keep turning, and you cannot do business on last year's operations.

So it is that for such purposes as this, the great number of colors that exists is a factor of great value to the manufacturer. But at the same time, it is a factor which he has used with such prodigality and waste of opportunity and lack of understanding, that he finds himself in a never-ending struggle lest it overwhelm him.

It is true that the human eye is able to distinguish half a million different colors. But it is also true that any such figure as that is of philosophical interest only, and not of any practical interest. The differences in any such aggregation as that would be so minute that their sole purpose would be to test the discriminating power of the eye. Lay aside that figure, then, and consider merely such a group as ten thousand different colors. You will find almost that number in the Dictionary of Color. If any plate be examined, in most cases any two contiguous colors will be found to be so close, that on off-hand inspection they seem to be practically alike, and it is only by the use of an isolation mask and careful matching that the difference is made apparent. How much

more impossible, then, would it be to distinguish the difference between such close colors in the ordinary conditions of our surroundings, where texture, outline, draping, the variations in the angle to the light and to the eye, and the nearness to the windows and artificial lights, all combine to throw innumerable gradations of tone over colors.

Now the public can purchase only what is manufactured and placed on sale for it. It would be perfectly feasible therefore for manufacturers to so organize their color factor as to reduce the number to a practical and commercially desirable limit. Take, for instance, the Standard American Color Card. It contains about two hundred different shades, ranging fairly well through all the colors. But consider then the two Seasonal Cards each year. If we wave aside all sales and advertising nonsense concerning new colors, and compare these colors on the ground of rock-bottom common sense, we are forced to admit that as a group they differ as a group in no way from the standard colors. So far as being "new" is concerned, they are "new" in name only. A good many of them are actually identical both with other "new" seasonal colors of former years, and with standard colors. But eliminate all these, and consider only those which are perceptibly different from the standard shades. In what conceivable way are these slight variations of any benefit to the world? Why, the majority of them, after they have been in use for sometimes only a week or two, fade so that they become in truth another shade, and are no longer the ones that were purchased!

The argument may possibly be given me that they are necessary because of the requirements of color harmony and color schemes in decoration and costume. I reply to this, that under the present ideas of color harmony and color schemes, this is so to a certain extent, for with most women today, the idea regarding color schemes and color harmony is that their colors must match exactly. We had an example of this, and the trouble it caused manufacturers and dealers, in the case of the Robin's Egg Blue kitchen. The cure for this difficulty must be the removal of these false notions concerning color harmony by a re-education of the public. That could be very easily done in connection with advertising. Many firms are now constantly distributing booklets dealing with color harmony; I have quite a collection of such material, which range from simple booklets given away free, to elaborate pamphlets with beautiful colored plates, for which a charge is sometimes made of ten cents or a quarter.

There is a deal of pother made over color harmony, and a lot of nonsense talked concerning it, frequently by professional so-called decorators, who like to create the impression that color, usually written with a capital C, is a deeply mysterious art or science, the exercise of which requires either an inborn genius, which they by inference possess, of course, or a highly specialized and toilsome study, which only an inner circle of initiates gain the secret of.

If you think this is an exaggerated statement, read some of the articles in periodicals on the subject, or go talk to some of the colorists and stylists in the textile business. You all know women who claim to possess an "intuition" for color. How often don't you hear one woman say to another: "Oh, my deah, you should never wear Robin's Egg Blue; Orchid is your color." I delight to meet one of this sisterhood, and always lead her to chatter out all her intuitive ideas on color, and I always ask what "my" color is. It has never failed yet that each one of them knew exactly what my color was, but the funny thing is, that no two ever agreed, and the colors that are supposed to be especially favorable to my type of beauty ramble all over the spectrum.

Now as a matter of fact there is nothing whatever mysterious about color. But it has so long and so cleverly been hedged about with this verbiage of high-sounding and meaningless phraseology, that a large proportion of the common folk of the world have been fooled by it.

This whole "art" of color harmony can be explained in a couple of sentences. Certainly if I were to write an advertising booklet on the subject, or a little book to be published and sold—it could not possibly be a large one—I would not confine myself to two sentences. There are a number of aspects of the subject which it would be interesting to play around with and use up a lot of words on, such topics, for instance, as taste in color, which is so often confused with harmony of color by the high priesthood of decorators and designers. Some people like bright colors, some like dull colors. Taste is entirely a matter of personal preference, and has not the slightest connection with the harmony of colors.

It may be thought that I am going to edge away from my statement that the whole art of color harmony can be summed up in two sentences. But I am not, and I am now going to explain it to you. Sentence One: Avoid the use of combinations of colors of approximately equal intensity that lie closely on both sides of the primaries. Sentence Two: Avoid the use of combinations of colors that differ so little that they look like a match that failed to come off, or as if one of them were faded. The reason for the first is physical; it is due to a conflict of vibrations on the retina of the eye, by which a feeling of discomfort is produced, somewhat analogous to a discord in music; it is a complicated, highly technical matter, involving the use of mathematics to explain, which we could not enter into at this time. The reason for the second is intellectual and quite self-explanatory: we dislike failures of any kind, and we dislike faded colors.

Avoid these two situations, and you can hardly use any combinations of colors that will not be harmonious. I suppose this statement would bring down on my head a clamorous chorus of protest, denial, and condemnation from the professionals. It takes away from them all those mysteries and secrets and fictions with which they build up an absolutely non-existent art. But it takes very little thought to realize that everything else is a matter of the conditions under which the colors are used, the objects to which the colors are applied, the materials of which they are composed, and the designs or patterns; and these things have nothing at all to do with the laws of color harmony.

If, then, a sane and rational idea of color harmony could be brought into public consciousness in place of the present complicated and distorted notions, much of the difficulty in regard to color that exists, not only in the textile industry, but in all others, could be eliminated, and it would be possible to get along with far fewer shades. If the lady who attempted to appoint her kitchen throughout in Robin's Egg Blue has been successful in obtaining everything in that kitchen of the same identical shade, she would have grown deadly tired of it in a very short time. The special problem of the woman herself lay not in any color, but in the fact that she was fascinated by the term Robin's Egg Blue; she wanted to tell her friends all about her wonderful Robin's Egg Blue kitchen, and how she would have rolled that phrase Robin's Egg Blue on her tongue! If she had accepted the variations in color which the manufacturers were able to give her, she would have had an infinitely more beautiful and interesting kitchen. She could still have bragged about her Robin's Egg Blue, and none of her friends could have told the difference. Variety is the spice of life. The first time you hear a catchy new popular tune, you think it is great. But after you have heard it day after day from every station on the air, you soon feel like throwing a chair at your radio. The reason why silk has always been considered the queen of textiles, is simply because the sheen of it produces a change and play of color in it that delights the eye.

But so far as variety in color is concerned, there are these other things that influence it, form, material, design—and design particularly, both as to outlines and patterns. Now the very existence of pattern so affects the mind by the interest in the design itself, that the colors used are practically unimportant.

This can be demonstrated very simply and positively. If you take an outline pattern, and hand it to a hundred designers or colorists, with instructions to insert the colors, you will get one hundred results, all different. Even if you specify a certain color scheme for the pattern, you will get one hundred different results. Your Blue will be of all sorts of shades; your Red will be of all sorts of shades, and so likewise with the other colors you specify. And there is absolutely no criterion by which one of the lot can be judged to be the best. If one judge selects from this lot of a hundred examples a certain coloring which he thinks is best, ten other judges will be sure to select ten other and different colorings. It is all a matter of personal taste. It depends entirely upon how much contrast you happen to approve of in the pattern, or whether you happen to like the pattern light or dark, in bright colors or dull ones, with a single color predominating, or showing in a number of equally dominating colors, and so on.

But go further. Restrict your specification to one such class of effect. You will still get one hundred different results. And you are bound to. Any such thing as the application of color to pattern is a human activity which comes into existence through the focus of a human personality; and just as no two persons were ever alike, so their ideas must differ.

But go still further. Consider these three methods of demonstration as being self-evident, and try this one, which I have practiced more than once. Make an outline tracing of a colored pattern which you have obtained from some designer. After the lapse of a short period of time, return the tracing with the request for a new coloring exactly identical with the original. Some designers will say they cannot remember the colors. But others will readily enough furnish you with the new coloring. Are the two colorings alike? They are not. Furnish a written description of the original coloring, if you like, however carefully written, and the two will still differ.

It follows from this that there exists in colored pattern no such thing as laws of color harmony, by virtue of which the use of certain specific colors in one portion of the design demands certain other specific colors in another, the change in one demanding a corresponding change in the others. That is why I said that in pattern it is the design that holds the interest. The exact shades of color used are absolutely unimportant, and have no effect whatever on the beauty or the success of the pattern.

But a good many designers tell you the opposite. And they have been telling so long and with such emphasis, that no small percentage of people believe it. A good many designers consider themselves artists. It is true that there are many artists among them, and the standard of design today in textile prints is so high that it does actually constitute an art. Now one of the marks of your artist is temperament, and so your average designer feels that he is not truly an artist if he is not temperamental enough to refuse to be bound by restrictions that would be of commercial benefit. So he uses countless colors of myriad different shades, and he strives constantly to get different ones; he insists that his design will

be spoiled or will not be successful if the colors he uses are not matched exactly in the print shop, and he cares little for the difficulties which he lays on the printer. And the owner of the shop has so long been fed these ideas, that he never thinks of questioning them.

I will give you an illustration, an actual occurrence. A few years ago, when there was a great run of popularity on fancy striped ribbons for hatbands and garters, and so on, a friend of mine, who owned a mill, invited me to his office, and showed me shelves stacked to the ceiling with ribbons that would not sell. I examined these ribbons, a large number of designs, and found that they were horrible in design. It was plain that my belief that they were horrible was not in this case a matter of personal taste, but that there was something intrinsically bad about them, in the simple and existing fact that there they were and would not sell. Moreover, in the lot of them there were no two colors alike, and not a single standard shade, but all off-color, fancy colors that must have run up his cost materially. I asked him how much he had paid for the designs. He told me he had paid five dollars apiece. I said to him: "Oh no, you didn't, you paid several thousand dollars." Finally he begged me to make him some new designs, which he knew I could do, though I am not a professional designer, and have no desire or intention of being one. This I agreed to do to help him out. I chose five of the most common of the standard shades, and with these five colors, I made him a dozen patterns. Of course, not all the five colors were used in each design, and the number of stripes was kept low, in order to keep down the warp setting cost. He wove up these patterns, and they had such a ready sale, and the cost was so low, that he finally pulled out his loss, I believe, selling the old stock for anything he could get, to get them out of the way.

Now, with so simple a case as this, compare the elaborate designs used in silk and cotton prints today. It should be apparent that manufacturers throw away a lot of good money in the production of a long variety of subtle colors which have absolutely nothing to do with the beauty of the designs or the sale of the prints.

I know that if I were a manufacturer of textile prints, I would standardize my colors. I would buy my designs for their pattern alone, and I would pay no attention to the exact coloring of them. I would select a short list of easy working dyes, which I would keep constantly in use, so that the printing would become a matter of mechanical routine. I would lower the cost of production, so that I could make a desirable profit, while selling at a figure that would command the trade. I would base my entire business upon the beauty of my patterns, and I would pay such prices for my designs as to obtain the most artistic work possible.

I think this would be a good place to stop. By the use of standardized colors, I am now getting rich, so why go further?

Before concluding, however, I should like to bring a totally different matter before you, seizing the opportunity in my own behalf. I am very much interested in old textile colors and color names. It is a sort of hobby. In the Dictionary of Color, I have collected as many as I could find of record, but there must exist many more, the knowledge of which, or samples of which, may be in the possession of individuals or firms. In future editions, I hope to include more names. While many such colors are of no practical use today, they are of great interest and even value historically. I should therefore like to make this suggestion that anyone who has any old color cards, American or foreign lying around the place, which he may consider as of no longer any value to himself, and would like to get rid of, may possibly feel so kind-hearted as to send them to me. This would include also some of the older Textile Color Card Association cards. I have all the late ones, but some of the earlier cards are not obtainable from the Association, and are difficult to find. It would also include named samples of goods of earlier days. In all cases, it would be of great value to me to have the date of the card or the sample. You will note in the Dictionary of Color that we have given the dates in which the various color names came into use, a fact of very great value to period designers and decorators, as well as of general historical interest. Perhaps some of you may have information that will enable an earlier date to be found. On all such matters, I would like to have this request made known in the trade, and any information may be sent to me at Ridgewood, N. J., or if you forget that address, direct to the publishers of the Dictionary of Color, the McGraw-Hill Book Company, Inc., New York City. I would greatly appreciate any new facts in regard to color names, and especially any older color cards, no matter how much worn out they might be.

* Presented before the New York Section, November 21, 1930.

Textile Research*

By Dr. D. H. Powers

DOES it exist? How many plants have a single man in their employ who is free from the routine of daily plant problems, free from interruptions, interferences, unnecessary delays and discouragement? Unless a plant has such a man, or men, in its employ, it does not have and does not know what research is. I venture to suggest that there is hardly a textile plant in New England that knows, from its own actual experience, what textile research is, and yet, what industry needs it more, what

industry is more subject to seasonal changes, more in need of new developments, new processes and new products?

Value of Research

Is there any question as to the value of research? It has been conservatively stated that every successful firm has somewhere in its organization a research staff. It has been maintained that 90% of present-day industrial success is due to the intelligent application of applied research. It is unnecessary to point out that millions of dollars have been spent on research by the large successful companies, and it is certainly interesting to speculate as to whether these great organizations have research because they are large, or are large because they have research. Why, then, should research be such a curiosity, and why should there be such a dearth of this type of investigation in the textile industry?

Reasons for Absence of Research

There are a number of factors contributing to this condition. One factor is lack of appreciation as to what research really is. It seems to be a common opinion that the employment of a chemist, or of a "man who once took chemistry," constitutes the establishment of a research organization. I am sure there is hardly a textile chemist, even assuming he is of research calibre, who has ever had a chance, free from interruption, to carry out textile research. Another reason for lack of research in this industry may be because the large research laboratories of national reputation appear to be extremely expensive luxuries. They are certainly not luxuries or they would not be maintained in these times, and their return more than justifies their expense. A recent development, costing about one hundred thousand dollars, netted a minimum saving of over three million dollars. This development was not in the textile industry. Is there any reason why the *small* research laboratory may not be just as profitable? The percentage return on the investment may be just as high, and a few research men may constitute just as valuable a research organization as a huge establishment; but they must be free from constant interruptions, interference, unnecessary delays and discouragement. It is my belief that the investment, by every textile plant, in a research organization, consisting even of a single man, free from the daily interruption of plant problems and delay, is certainly justified. It is a far safer investment than it would be to buy a few shares of stock, and you can be sure it will yield a greater return than the present market indicates that present stocks will. Another reason for the absence of textile research may be that some feel that there are no problems, but how can this be intelligently held? Are there any textile processes which we have thoroughly investigated or understood?

Research Problems

Why do we dye at 160° or 180° F.? What happens in a vat ager? Why do certain times of aging give better results than others? Is caustic the best mercerizing agent? Why do some colors dye rayon differently than cotton, while other colors do not? What is the mechanism of color absorption in printing? What constituents contribute to the stiffness or softness of a finish? What effect has processing on the fastness of colors to light or washing? There seems to be no field as promising as the textile field, with the great number of problems on which no work has been done, the variety of work which can be done, and the immediate value assured upon application of these findings. But any investigation to be of value, to be research, must be carried out by a man free from constant interruptions, interferences, unnecessary delays and discouragement.

What Is Research?

Perhaps one difficulty in the textile industry lies in the fact that research, and what it is, is rarely appreciated. A great deal of work which is merely testing passes as research. A great deal of work of a routine nature is turned out and discussed as a research problem. Much work is turned out in which the investigator had no choice of problem, no freedom of thought, and no latitude of study. Research may be defined and classified according to the freedom with which the investigator is allowed to work. Industrial research may be of just as high a grade as any university research, and be of just as much practical value by virtue of its high quality. We hear a great deal about pure research. Pure research may be exactly the same as industrial research; the only difference between pure and applied research lies in the motive in back of the work. In pure research the motive instigating the work is the desire to find out more of the fundamental facts and laws. In applied research the work may be identical and the problem may be the same from one end to the other, but the motive for the problem undertaken may be the simplification or improvement of a plant process or product. However, in either case, the investigator must have been allowed a certain freedom of thought and action, or else it was not research.

Classification of Research

Research work may be divided into three classes, according to the freedom with which the investigator is allowed to proceed. In any problem there are three factors:

(1) What method to use; that is, how?
(2) What materials to use, for example, what dyestuffs?
(3) What medium in which to carry the work out; for example, rayon or silk?

When an investigator takes up a problem and is not limited as to method, material or medium, it is a research problem of the *first class,* that is, research of the highest type, because the investigator is not limited in any respect. The highest type of man is required for this work and the results obtained may be of greater value. Where the investigator is limited in all three factors, namely, method, medium and material, there is no justification, whatever, in calling this work research at all, as the worker is allowed no latitude for his investigating ability, and is merely carrying out a routine testing problem. He is only doing a bit of analytical work, which any investigator can do who follows instructions. I do not feel that we have any grounds in calling this type of work a piece of research, but rather it should always be referred to as testing. It is a mistake to confuse this "routine take and test" with the highest type of work which we call research. Practically all of the work which is now carried on in the textile industry is some type of testing. The investigator is allowed no latitude and no degree of freedom and no scope in his research. When the work is limited to testing, its value as research stops and its commercial value is tremendously lessened. When we run a routine test on a dyestuff for strength, we know the approximate value of this test before we start. However, if the investigation of the dyestuff is taken up as a research problem, its possible return is unlimited. A new process of application, a new effect on a mixed fabric, a new degree of fastness, an entirely new method of handling, or an entirely new range of finishes is entirely possible as a result of this fundamental research.

Research of the *second class* is where the investigator is allowed two degrees of freedom, that is, the investigator is limited in his method and allowed freedom of material and medium, or he is limited in his medium and is allowed freedom of method and material, or he is restricted in his choice of material and allowed freedom of method and medium. An example of research of the second class would be the study of the effect "complex ions on dyeing." The investigator must not be limited in his choice of dyestuffs, he may try basics or vats, directs or sulphurs, he must not be limited in his choice of fabrics—he may try silk or wool, linen or rayon. If he is given this freedom, the investigator has the opportunity at least to do a piece of research of the second class—freedom of medium and freedom of material. But you may raise the question, "I am only interested in the application of vat colors to cotton." The only answer to this query is that if you so limit your investigation you immediately stop your research. Instead of finding out how and why these "complex ions" act on dyeing, a problem which, if thoroughly understood, might greatly cut dyeing costs, you only obtain a piece of *testing* work, which will only tell you whether or not the resulting shade is darker or lighter. There are any number of problems which should be studied as a piece of research, yet 90% to 95% of their value will be lost because they will be studied (if at all) as testing problems.

The *third class* of research is the lowest class of research where the investigator is limited along two lines and allowed freedom only of method, material or medium, and limited in the other two. In the textile industry, perhaps the best way to start research work would be to begin with problems of this class, and gradually work up to the second and first classes. If we must know in advance just how much our research is going to be worth, the best thing is to give up the idea of research and take up testing. We can tell at a glance just about the value of a piece of testing. There is rarely a possibility of its ever being much more valuable than its cost.

However, in the case of research, its possible value is unlimited and its actual value is only limited by the skill of the investigators, the freedom with which they are allowed to work and the co-operation granted in the application of the fruits of their labor. It is unnecessary to cite the countless cases of research which are known to be worth—by any method of calculation—ten, hundred and one thousand times their cost.

Textile Research in England

A recent example of present-day textile research is found in the latest report of the Fabrics Co-ordinating Research Committee of the English Department of Scientific and Industrial Research. A report is made on the Fireproofing of Fabrics. This work appears to be a very thorough piece of research of the third class, since the investigators limit their *medium* to cotton, and their *method* to the usual impregnation process. The materials are varied and varied widely. A complete literature survey is made before the work is started, as research work is never justified if "someone has already done it." Their report lists over four hundred patents, dating from 1735 and covering the use of approximately seventy compounds, of which perhaps a half dozen may be of practical value. With a starting point of all the compounds mentioned in the patents, the research is limited to the study of the accurate testing of their relative flame-proofing properties and their effect.

Textile Research in Germany

Another example of textile research is the work of Nowack and Buttgenbach on the Glucose-Hydrosulphite Vat (Melliand Textilberichte, Vol. XI, page 213 (1930)). This appears to be research of the second class, since the authors investigate the *method* of vat dyeing with hydrosulphite and glucose, and also investigate the *materials,* since they vary both the dyestuffs and the hydrosulphite,

glucose and caustic soda. By virtue of the fact that the authors study this problem as a research problem, rather than one of testing, they are able to draw conclusions as to the general effect of glucose in dyeing vats with and without caustic soda, and to point out what types of colors it may be expected to assist or harm, and why. They are also able to predict, to a certain extent, under what conditions it should be used and its limitations. These examples of textile research have not been purposely chosen from foreign work, but rather because there is little, if any, textile research carried out and published in this country.

Application of Research

From a practical point of view, research is successful only in so far as it is applied promptly, economically and with the least interference with present operations. The most thorough and most scientific research pays for its completion only if its practical application is possible and complete. There is no doubt but that another reason for the absence of textile research is due to this lack of facilities and co-operation in their practical development. Even if a theoretical problem has been advanced to the laboratory or "beaker" stage, there is still the big jump to full-size production. The most successful method, and perhaps the only practical method, for conversion from the laboratory to the plant is a laboratory-works.

Laboratory Works

The laboratory-works is the place where the "beaker" experiments can be carried out and studied on a plant scale—without tying up production. In the laboratory works there must be full-sized plant equipment available for the study of the new processes. This equipment is not necessarily in a separate building and it is not necessarily always kept just for laboratory development work, but it must be available at certain definite times for research on processes—and for it to have the maximum value it should be available at all times. For your investigation to be research, it must be free from the interruption of daily plant problems, free from nagging, interference and unnecessary delay.

Application of Problem

Let us assume a new dyeing or printing process has been developed in the laboratory and shown promise—what chance has this process for practical application unless each detail can be studied and changed and modified and rechecked on plant equipment? Yet, what plant—and particularly the successful one—can let one of its print machines or dye becks be loaned for research for a day, week or month? For the practical rounding out of a research development, it is clear that a laboratory-works is absolutely essential, and all arguments in favor of research can be equally applied to the establishment of this laboratory-works as a means for the practical application of their "test-tube processes." With the installation of a laboratory-works, application is found not only as a means for studying new processes, but also for a great deal of routine testing, such as strike-offs, modified print formulae, dyeings on new fabrics and the study of new constructions.

Plant Laboratories

At the present time most textile plants have laboratories whose work may be subdivided into three types:

(1) Analysis and routine control
(2) Investigation of daily plant problems
(3) Investigation of new products and processes.

While this work may be broken up into these three headings, it is all usually of a testing nature. It is entirely possible that with a slight modification of the above organization, and possibly the addition of a few men, at least a start might be made in textile research investigation. The following tentative modification is suggested as a means of making these changes:

(1) Analysis and investigation of routine control
(2) Study and classification of daily plant problems
(3) Investigation, development and application of new products and processes, and their application in the laboratory-works.

Routine Control

Even in analytical work, a freedom of investigation in the application of research may be of practical value, and it has been consistently shown that savings can be made if the usual routine analysis is replaced by a routine testing, based on an investigation of the purpose for which the product is used. This seems an obvious line of attack, yet it is amazing how often a chemical product is tested for some property which is entirely unrelated to the properties for which it is used; for example, Glycerine is usually tested for its reducing action or its free hydroxy groups, when, in actual practice, we do not use this product at all as a reducing agent.

Daily Plant Problems

In the study of daily plant problems, the first requisite is, of course, a prompt report, so that there is little opportunity for investigation and research. However, this work can be greatly simplified if the problems received are classified, and if those types which are most numerous are subjected to research, a clear understanding of the cause for these troubles may be determined and complete elimination is possible.

Development Work

It is my plea that the development work be kept as free as possible from daily routine and plant problems. This means, of course, that the same man cannot handle

both types of work, and research is only possible if you allow one or more men their entire time for research. As previously pointed out, there is no question as to the value of this work, from a theoretical point of view, but to make this work of practical value a laboratory-works must be available for a practical study. If possible, the development work should be broken up into two or three divisions—one man specializing and devoting all of his time and energy to the preparing and dyeing of the cloth, another man to the printing and aging of the cloth, and still another man to all types of finishing. These problems are so unrelated that best results may only be obtained by training men to be specialists in each of these lines.

Type of Men

Finally, the establishment of any research work is dependent, more than anything else, on the proper selection of good men, as there is nothing which can substitute for men of the right quality. Money, facilities, opportunity and co-operation are of no avail if the proper type of men are not carrying out the work. The best type of man for research work must have three general traits:

(1) A large amount of common sense
(2) Ability to correlate and associate
(3) Power of observation.

Common sense, or perhaps chemical sense, is absolutely essential, and it is surprising how often problems of great possible importance go astray due to the lack of application of common sense. The ability to correlate means that your worker can accomplish as much in a half hour as a man without this ability can accomplish in a week. The case is well-known of an analyst who spent two days determining what was in an unknown compound and was still at a loss as to its probable structure when Berzelius correlated for the analyst three of the initial tests, showing him what the compound was. Power of observation and its importance is constantly indicated by the fact that many of our most important inventions and discoveries were merely the accurate observation of phenomena which were of daily occurrence; for example, the discovery of the vulcanization of rubber. I have purposely omitted any reference to the training of your investigator, as a man with the highest training without these attributes is of little value, whereas a man of far less training, but with these attributes, would be of much greater value.

Conclusion

In conclusion, the absence of research in the textile industry is to be lamented. Its value is unquestioned, but it must be remembered that it is only possible if you will allow the right type of men freedom from daily plant problems, freedom from someone constantly dictating just how each step should be made, and freedom from constant interference and discouragement. They must be impressed with the importance and dignity of their position and must be backed by money that is willing to wait.

* Presented before the Northern New England Section, November 8, 1930.

Chairman Grimes: Are there any questions?

Mr. Durfee: Mr. Chairman, it strikes me that a concern like the Du Pont Company should be counted a part of the textile industry, and I feel that one man in a large organization like this, with the facilities of a large plant to work with, is able to do more work and better work than a number of men in smaller plants.

Dr. Powers: It is quite true that any work that Du Pont or a similar company does will be of value to the industry as a whole, but each individual textile company must work out its own specific problems for itself. If you are going to do something a little better than your competitor, if you are going to work out a little better finish, or get a little more color value out of your colors than your competitor, you must work out these problems for yourself. We must remember that no outside firm, no matter how efficient it may be, knows your own organization and your own problem as well as you do. It appears to be generally true that the dyestuff companies tend to work out problems of general interest to the textile industry, but you must work out your own particular problems.

The work of Seibert on the "Level Dyeing of Rayon" published in the American Dyestuff Reporter of January 6, 1930, is an example of the case in question. This is a high grade piece of research on the effect of method and dyestuffs used on the level dyeing of rayon fabrics. There is no question about the general value of this work to the textile industry as a whole, and of the need for more and more of this type of work to be published. But each individual plant gains by this work over his competitor only if he applies it to his own problems more thoroughly, more accurately and more intelligently than his competitor. I am sure that you do not feel that we should sit back and let the dyestuff industry work out all our individual problems for us. It is worth considering that perhaps one of the reasons why the dyestuff industry is in better condition than the textile industry is due to the fact that they do work out their own problems.

Mr. Durfee: Isn't there a danger that there will be a duplication of the work which you are doing in one finishing company and the work that a brother chemist is doing in another company?

Dr. Powers: It is true that a certain amount of similar work will be done in the different plants, but no two

plants have quite the same interests or quite the same types of problems. I hope the time will come when all the textile companies will publish the work of a fundamental nature that is carried out in the different plants. It will then be necessary for each individual plant to apply this general information more intelligently to its own particular problems. But we cannot wait for someone else to do our research for us. Research in your own plant is your only investment against varying conditions and hard times.

Mr. Davies: What is your opinion of co-operative research?

Dr. Powers: I think that it is a very valuable thing, and I hope that before long we may have it in this country. The English have shown us the possible application and the value of co-operative research. There is no question that the work at Shirley is of real value and of a high quality. However, I feel that in this country individual plants must improve their own laboratories before they are in a position to make use of this type of work. How many plants in this country are making use of the work that is being published in England and published in the "Journal of the Textile Institute"? Assuming we establish a co-operative research laboratory in this country, and that it turns out work of a high grade, how many plants are in a position at the present time to make use of this work? I think that we must first make every effort to build up the laboratories in the individual plants, and these laboratories will, in turn, sell the idea of a co-operative research organization.

Mr. Davies: How can the small manufacturer indulge in research, and with what department should the research laboratory be connected?

Dr. Powers: Your research laboratory should be connected, as nearly as possible, with the head of the organization; and not too closely to the production heads. We know that if your research work is too close to your production head there is a continual tendency for the work to be diverted more and more from applied research and put on immediate production problems. Your only hope for real research is to have your organization removed from production problems. Your individual plant laboratory and the plant chemist who is studying your plant problems should be close to your production head, but your research, if possible, should be connected with someone in your organization who appreciates the methods and processes in research and who is willing to wait for the thorough investigation of the important problems.

Mr. Davies: That is just the point that I wanted to make—that your research cannot be too closely tied up to production.

Mr. Lane: I think we all agree that the speaker is right. Can he suggest any means or method of bringing this most interesting subject to the attention of the manufacturers or to the people who control the textile mills?

Dr. Powers: In a great many cases it must be the chemist himself who sells the value of research. You hear chemists constantly saying, "they won't let me do research." The reason that they won't let you do research is that you have not convinced your immediate superior or manager of the value and importance of research. The plant chemist is the only man who can do this and unless he, himself, is really convinced of its value, he cannot in turn convince his superiors.

Perhaps the best way to sell research to your superiors is to do your research work first; work out your problems and then ask for the appropriation. It is amazing how much research was first started in this way. If you, yourself, are really convinced of the value of research, you will take up some plant problems, either overtime or during spare time, on your own responsibility. After you have worked out a problem—it may be your first, second or third attempt—you will take it up with the management, pointing out to them the value you have already found in this bit of research, and ask them to let you go on. If possible, take one man in your organization and have him carry out one piece of applied research, such as the study of color costs or the application of certain types of colors.

Intelligent study of a problem of this sort may be reasonably expected to yield a saving of 20% to 40%. With a problem of this sort completely solved, it should not be difficult to go to the management for permission to take up research along other similar, valuable lines. In other words, show some tangible results before you ask to be allowed to do research.

ADDRESSES WANTED

The Secretary would like the present addresses of the following members listed below with their last known addresses:

L. M. Bowes, Box 60, Charlotte, N. C.
J. Andrew Clark, 11 Lindy Ave., Providence, R. I.
Thomas E. Bell, Roessler & Hasslacher Chem. Co., Bleaching Station, Perth Amboy, N. J.
T. B. Clendennin, Signal Mountain Hotel, Signal Mountain, Tenn.
John Fisher, Rochelle, Ill.
David C. Hardman, 554 W. Chestnut St., Lancaster, Pa.
Louis Hoehn, Jr., c/o The Paris Company, 306 W. 31st St., Chicago, Ill.
Wm. F. Isom, Statesville, N. C.
C. J. Kenlan, 1432 Narragansett Blvd., Cranston, N. J.
R. H. Nuttall, 2225 Central Ave., Augusta, Ga.
Carl Oberholtzer, 2820 North 11th St., Philadelphia, Pa.
Thomas W. Pickup, 1114 5th St., Hartsville, S. C.
James P. Sullivan, 112 Westervelt Pl., Passaic, N. J.

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Custer, Harry J., manager of dyeing department, Concordia Gallia Corp., Allegheny Ave. and Boudinot Sts., Philadelphia, Pa. Sponsors: A. M. Burt and Percival Theel.

Knapp, Charles H., chemist, Collins & Aikman Corp., 4675 Nixon St., Manayunk, Philadelphia, Pa. Sponsors: W. Rollins Keen and Henry J. Bogan.

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Johnson, Norman A., student, Lowell Textile Institute, Lowell, Mass. Sponsors: L. A. Olney and John H. Skinkle.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

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Vol. XIX December 8, 1930 No. 21

IMPROVED BUSINESS OUTLOOK

WHILE business is still below the peak of this time a year ago there has been some improvement in the last few months and a slight betterment in the employment situation. A survey just made indicates an upward curve of confidence and in the late winter or early spring there should be a gradual and definite upbuilding. John E. Edgerton, president of the National Association of Manufacturers, told the Chamber of Commerce of the State of New York at its 162d annual dinner at the Hotel Astor.

Mr. Edgerton, who was the chief speaker of the evening, made this statement on business conditions as the result of the replies he had received to a questionnaire sent by telegram to the presidents of State manufacturing associations in eighteen of the principal industrial States, asking them to wire him their opinions of business, industrial and employment conditions in their States as they are today. The eighteen States are California, Colorado, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Missouri, New York, Ohio, Oklahoma, Rhode Island, Utah, Washington, New Jersey, Pennsylvania, Connecticut and Georgia.

"I believe these eighteen States furnish an excellent barometer by which to gauge conditions in general throughout the country," Mr. Edgerton went on. "The messages, of course, are too long to read in full, but I will give you a composite view of them.

"Industries which seem to be slowly on the mend are steel, textile, public utilities, shoes, paper, building, beet sugar, stock yards, numerous specialties, railroads in some sections, automobiles and allied industries, one State reporting that this industry is just now making its greatest strides in years. Mining in some States is characterized as showing more life than at any other time, while this is offset by another State reporting its worst condition. Some States report that while they have considerable unemployment, it is not serious because the communities are benefited by diversification of industries, natural resources and a high average of individual purchasing power. Other States report that deposits in savings banks have increased by more than 10 per cent over what was in these banks a year ago; and that commercial deposits have increased. Also, that there has been a marked decline in the number of business failures. They emphasize that there is still a reluctance to buy.

WHAT WAGE-EARNERS PAY FOR SICKNESS

ACCORDING to a survey made by the U. S. Bureau of Labor Statistics a few years ago, two per cent of the American population is sick at any given time. The cost of this sickness aggregates the total of more than two billion dollars every year.

Since this survey, another made by a life insurance company shows that approximately $80 per year is spent by each wage-earner's family as the cost of sickness. This amount would not seem to be excessive—if it could be safely assumed that eighty dollars would cover the cost of all sickness from which the family might suffer. Unfortunately, no family can arbitrarily fix any given sum to be spent. Ill-health and its attendant medical attention may not be the only items to make inroads upon the family's "sick budget." A large dental job may present itself; a major operation may suddenly be required, or a contagious disease may infect some or all of the family—then where does the eighty dollar budget come in?

An average of $80 for a sick budget represents a combination of larger and smaller amounts that vary from next to nothing to thousands of dollars per year. So long as sickness expenditures do not exceed the eighty dollars, so long can the budget hold its own. When it exceeds that amount trouble begins—for that family. They are either forced to go into debt, or accept charity. The latter is something nobody cares to do, so it often happens that the family resorts to quackery, patent medicines or does without medical attention entirely.

Tuberculosis, alone, is responsible for a death rate that is from eight to twelve times higher among certain industrial workers than it is among farmers, for example. As menacing as these figures sound—and, in reality, are—the tuberculosis death rate has been declining since those statistics were compiled a few years ago. It is still altogether too high (79 out of every 100,000 persons), and tuberculosis still kills more persons between 18 and 40 than any other disease. At the same time, the rate has been cut in half in the last 20 years.

It is not too much to say that the educational health programs that are made available by tuberculosis associations have had considerable to do with this decline. Neither is it too much to add that the little Christmas seal that appears every holiday season has played its

part in proving that tuberculosis is preventable. The money derived from its sale makes it possible to present effective health programs; to establish clinics and especially to help maintain summer camps for children who will become the industrial workers of tomorrow.

EXTRACTORIALS

In a world of business stability, which is the ideal toward which we strive, a good many wants would remain unsatisfied, and a large number of productive possibilities would not be realized. The great advantage of stable business, however, is that it permits, or possibly it is more accurate to say that it depends upon, a sufficiently precise adjustment of output to current demand to enable a great variety of goods to be sold at a profit with no abnormal surpluses left over. We shall not approach any such ideal situation as this by standing still and shouting to people to buy what has been produced whether they want it or can pay for it or not. Neither shall we be able to correct errors of maladjustment by encouraging manufacturers to keep on creating goods in amounts that cannot be disposed of at a profit.—*Journal of Commerce.*

There was once a newspaper subscriber who found a spider in his paper. He wrote to the editor complaining. The spider, replied the editor, was looking through the columns to find what merchant did not advertise so he could spin a web to his door.—*Mark Twain.*

New England has had to strengthen its position as the result of all of the casualties which it has suffered during the past five or six years. Taxes which had been the bane of New England generally, have been overcome to more than a small extent. The statement has been made in these columns recently, and it was made on good authority, that in some parts of New England, taxes are today as low as or lower than in parts of the South. Again it is worthy of mention, that in Georgia, the recent addition of the 5 per cent income tax has created a very important stumbling block for mills in that state. So, any idea of wiping New England off the Textile map must be forgotten, and the plans for the future must be based on a more orderly competition, the realization that competition is more equal than it has been in a long while.—*Daily News Record.*

"The advertising executive and the medium through which he advertises must see to it that the desire you create is satisfied by the article recommended. The good-will of the public toward the producer, the goods or the service is the essential of sound advertising—for no business succeeds upon the sale of an article once. And to maintain this confidence of the public you and the mediums which you patronize have an interest that others do not violate confidence and thereby discredit the whole of advertising.—*Pres. Hoover to the Assn. of Nat'l. Advertisers.*

Color Inherent in Containers

By Waldon Fawcett

IT IS, perhaps, not open to argument that if the present span is fitted to be characterized as the "chemical age," the "electrical age," or what not, it may also be described no less accurately as the "package age." No latter-day transition in the processes of merchandise distribution is more complete, nor more revolutionary, than the trend away from marketing in bulk to dissemination of package units gauged in size and capacity to the needs or demands of ultimate consumers. Just because the drift to packaging is so pronounced in virtually all commodity fields, not forgetting staple raw materials, is there significance for the dyestuff industries in the latest development in package manufacture.

A new call for color in packaging has come from package users and is in a fair way to be met by a new class of carriers. Insistence upon the use of color, and yet more color, in package dress is by no means new. Indeed, it represents the very essence of the new era of packaging. The whole strategy of modern package design aims to not merely provide a serviceable and economical receptacle for the standard portion of goods but to invest the package structure with attention-arresting qualities and powers of advertising persuasion which will bestir an impulse to buy on the part of the general public which observes the self-selling package in a show-window or in the store. Color has, from the inauguration of the perfected package technique, been a main dependence for the creation of display properties or "self value," so-called. Now comes the deepened dependence upon color.

An ever-present ambition, in developing the poster quality or advertising mission of the package, has been the attainment of "all-over" color. To appreciate the soundness of the logic which sought color saturation for containers it must be borne in mind that the function of color in the modern package is not solely ornamental, nor yet utilitarian, only to the extent of providing an effective background for advertising messages. Matching in importance the publicity motif, and perhaps overshadowing it, is the mission of identification. The ideal package must be readily recognizable by old customers and by new prospects who are guided by a description which has been given to them. In short, the supreme desire of marketing strategists is to make the package a trade mark in fact, if not in name, for its contents. Patently there is no vehicle comparable with color—all-pervading, dominating, color—for expressing package individuality.

Until recently, the demand for all-over color in boxes, cartons and other familiar package forms must

needs be satisfied with coatings of colored paper, "tight wrapped," or otherwise applied. The advent of colored versions of cellophane and other species of transparent wraps, which was recorded in these columns some time since, only partially met the desires of packers who coveted colors integral with the package and consequently to be depended upon to endure as long as the package structure. Furthermore, the colored wraps did not solve the color problems of marketers who would feign drench with color their corrugated fiber shipping cases.

Inventions, domestic and foreign, have lately brought within reach of American shippers and packagers the means of investing containers with inherent color. Thanks to this development, wear and tear may take its toll of package surfaces without marring or obliterating the color clue. And, while the "color impregnation" processes are working their miracles on the one hand, behold, on the other hand, the requisitioning of a variety of colored fabrics for the re-inforcement of the transparent colored package-wrapping and commodity-wrapping mediums that have recently found extensive and increasing use.

A notable achievement in color transfusion in packaging stands to the credit of the Container Corporation of America. By means of "Myracol," a colored liner, a permanent cast may be given to any corrugated container. And at an additional cost, that, in carload lots, is nominal. Corrugated fiber shipping containers in a wide variety of standard colors are already on the market and the process is susceptible of rendering unique or distinctive special colors if individuality of hue commands a premium. In order to preserve the color ensemble in the box as sealed for shipment, tape is provided in a color to match the box color. The color invasion in this quarter is likely to produce unforeseen and far-reaching results by reason of the fact that it makes it possible for the average merchant to turn the colored shipping case to the purposes of a display container or service stand for counter or store use instead of discarding the carrier upon delivery of the goods.

Even more sensational in promise is the "color impregnation" process covering seamless, moulded pulp, hollowware containers, the American rights to which have been purchased by the Keyes Container Corporation of Boston, a subsidiary of the Keyes Fibre Company. While the particular coloring process mentioned is the property of the American licensee of the pioneer at Spandau, Germany, there is no reason to suppose that other versions of color impregnation may not be developed in connection with other formulas for the supporting product. Moulded pulp hollowware containers constitute the interesting unknown quantity of the packaging world. Introduced abroad since the war—one of the by-products of war-time invention in Germany—this strong, sanitary, lightweight medium has found extensive adoption in England, France, Germany, Scandinavia, Holland and Italy ere it has gone into quantity production in the United States. Announcement that several firms in this country will shortly place on the market moulded pulp barrels or drums, designed particularly for petroleum products, would seem to indicate that the spirit of competition will make up for lost time, once market entry has been made.

Automatic machinery flows the pulp solution into moulds of any shape required, and steam, gas, compressed air or other similar agent is employed to press the pulp against the walls of the mould, compressing the fibers and driving out the superfluous water. The containers are made and dried in one operation. Color impregnation may take place simultaneously, employing the patented color solutions which have been perfected by the inventor of the process. Impregnation with clear or colored solutions as per formula optionally renders the moulded pulp containers or other products air tight, water tight or electrically insulated. This property in the material explains the use abroad of this material for battery boxes, radio equipment, etc.

In considering the possibilities of color-impregnated moulded pulp containers and miscellaneous articles of commerce it should be taken into account that the raw material employed is the cheapest grade of wood pulp. Special moulds represent an investment approximating $100 each and there is opportunity for notable savings on internal packing due to the fact that the moulded containers may provide, as integral structural features, the "cushions," lugs, shoulders, buffers, etc., necessary for "suspension packing" of fragile articles such as glass bulbs, X-ray tubes, radio tubes, glassware, china, porcelain, etc.

That the market for colors for pulp impregnation may ultimately prove extensive is attested by the fact that the American program contemplates not centralized manufacture, but the licensing of the process and requisite machinery to large users of containers who will fill their needs by means of their own manufacturing plants on the plan followed by the Huntley & Palmer Biscuit Company in England and other large producers abroad. It is the opinion of the best informed observers in the container industries that the invasion of color via the new moulded pulp containers will operate to demand similar color service in other new types of containers just coming on the market, as, for example, the cellulose container or "can" for which the Eastman Kodak Co. is furnishing the material.

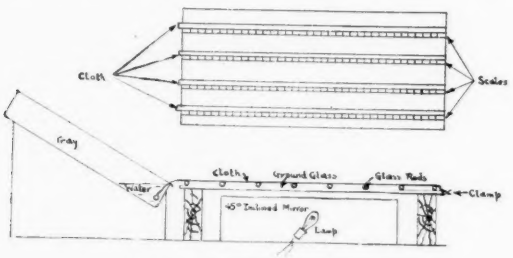
The General Dyestuff Corporation brings out a sample card, "Dyestuffs On Straw, Tagal and Chip Plait." The card shows illustrations of 177 different shades produced with Acid Direct and Basic Colors on the different materials. I. G.—171.

Future Textile Laboratory Practice

(Continued from page 761)

weight of the fabric before and after immersion gives, by subtraction, the total amount of the liquid absorbed. This may be rated to the bone dry weight of the fabric, in order to establish a percentage of total absorption.

Generally, the rate of absorption is of much more importance. To measure this quantity, the apparatus illustrated upon the slide, Fig. 11, has been constructed. It consists of a ground-glass-topped table suitably illuminated from beneath for visibility. The fabric to be tested should first be boiled off by the diastafor



ABSORPTION RATE APPARATUS

Fig. 11

method to remove the starch, sizing or other foreign materials in it. After this, the fabric should be pressed, to give a smooth, accurate surface. From the various fabrics to be compared, strip samples should be cut from selvage to selvage one inch wide. These should be accurately gauged to a width of one inch, and care should be taken that no threads are raveled or allowed to hang. At the left end of the table a photograph tray is located in an inclined position so as to be filled brimming full of water to the edge. The samples to be tested for rate of absorption are immersed simultaneously under definite tension in this tray full of water. The temperature of the water should be 70°F. Be-

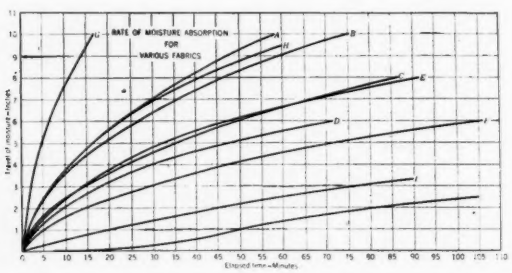


Fig. 12

tween the various strips of fabric stretched across the top of the illuminated table, scales in tenths of an inch are attached to the ground-glass. The progress of the water absorption along these strips will be perfectly evident, and by means of a stop watch the extent of the absorption may be measured and recorded at definite intervals of time. Having made this determination, the results may readily be plotted, as shown upon the screen, Fig. 12. The co-ordinates of the plot are the time in seconds and the extent of the water absorption. This method gives a fair gauge of the relative rate of absorption between a group of fabrics.

Many fabrics, such as those prepared to resist pneumatic or water pressure, are subjected not only to tension in one direction but to a bursting stress in all directions. There has long been a demand for a machine to determine with precision the bursting strength of fabrics. Many excellent machines for this purpose have been designed and placed upon the market. The slide upon the screen, Fig. 13, illustrates one of the modern forms of this type of apparatus, where the bursting load is applied by fluid pressure at a definite rate by means of the electro-motor. At the same time the bulge of the fabric is measured and recorded by a tilting lever and chart. This machine is a great step

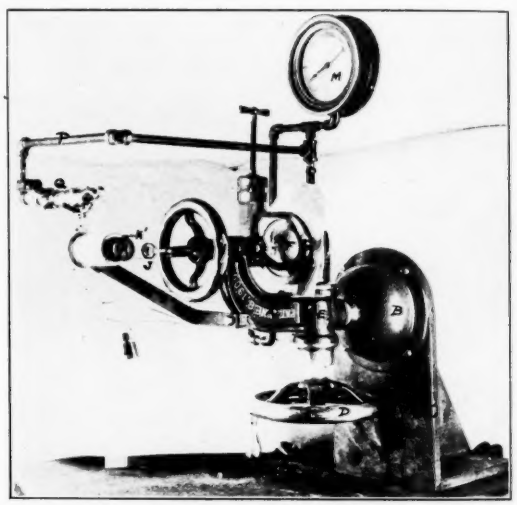


Fig. 13

in advance to any which has ever been constructed, and should have, in the belief of the speaker, a wider use.

(g) *Bursting Strength.* There is still, however, numerous factors which have not been satisfactorily adjusted in this type of machine. First, the specimens tested are generally clamped upon a ring either one inch or 1.2 inches in diameter. This is in the region of the length of the cotton fiber, and therefore does not give a thorough test upon the fabric itself.

It would seem a very easy matter to enlarge the clamp ring to at least 3 inches internal diameter and

thereby make the specimen comparable with those usually tested for tensile strength. One of the greatest difficulties with the present type of bursting testers is the fact that the rubber diaphragm does not rest against the fabric in intimate contact throughout the test. The rubber diaphragm is normally depressed below the fabric and does not touch it at all until considerable pressure has been applied. In the form of machine devised by the speaker, the rubber diaphragm, Fig. 14, was arranged to rest against the fabric before any oil pressure had been applied. Therefore the fabric was practically loaded with a uniform

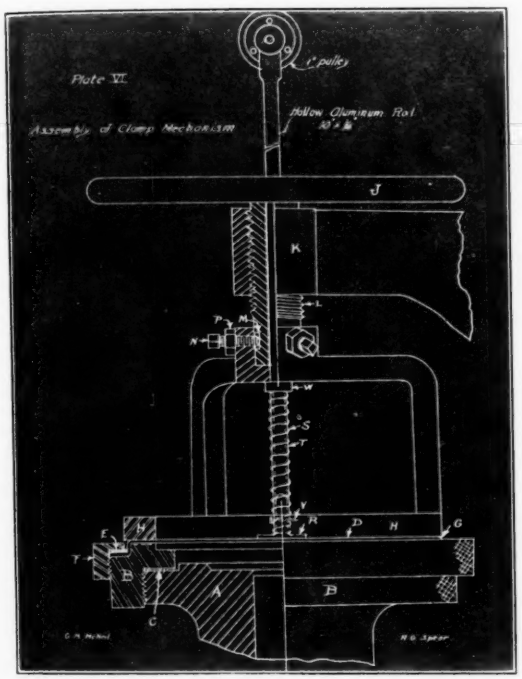


Fig. 14

pressure from beginning to end of the test. The results from such bursting experiments are perfectly comparable with those found for the same fabric upon strip or grab specimens. It is of the utmost necessity that no air should be imprisoned under the diaphragm. For this reason, the axis of the machine was arranged horizontally instead of vertically and the air was trapped out from under the diaphragm by small vents at the top.

The stiffness of the diaphragm has always been a question in this type of machine. Probably, when the rubber is new, there is comparatively little oil pressure used in distending the diaphragm alone, provided the larger size of ring is used.

The illustration, Fig. 15, shows the form of experimental machine used by the speaker in which the pressure of the oil and the distention of the diaphragm were automatically recorded upon a steam-engine indicator. To correct for the stiffness of the

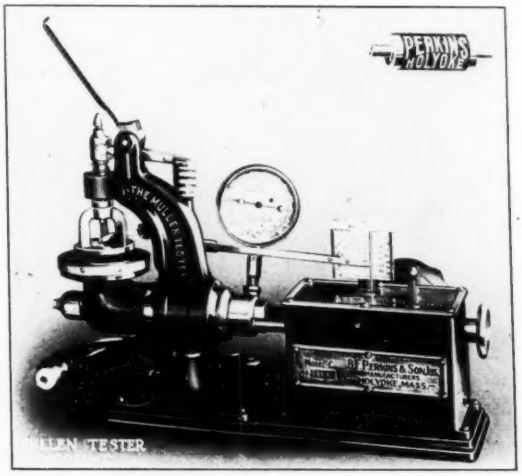


Fig. 15

diaphragm, a second card was drawn, with the same distention of the diaphragm as was found necessary to rupture the fabric. This worked out very satisfactorily, and gave a series of results entirely comparable with those found for pure tension. Of course, such a machine as this will always select the weaker set of threads, whether they be warp or filling, and the bursting strength will be based upon the weaker direction alone. In a sense, this has an advantage, since it indicates at one test whether the warp or filling is the weaker. While these experiments were, in a sense, crude, they showed conclusively that a refined type of bursting tester with larger ring, raised diaphragm and deflection-recording apparatus, could readily be used in determining the strength of fabrics.

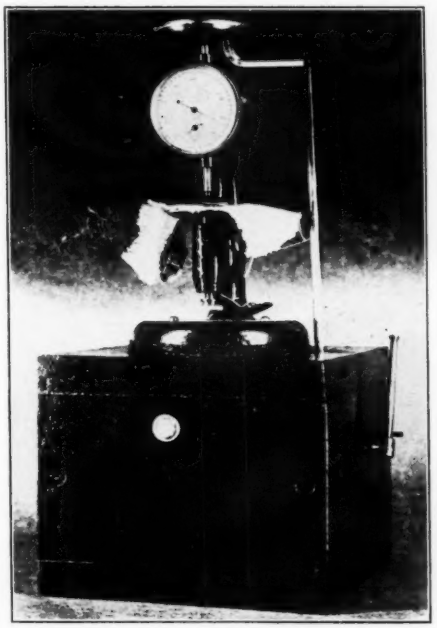


Fig. 16

Naturally, the measurement of the thickness of textile materials is fraught with much difficulty. The question of pressure, time, stability and impact causes wide variations in the results of any such determinations. However, it is necessary frequently to measure with as much accuracy as possible the thickness of fabrics and the diameter of yarns.

(h) *Precise Thickness.* The illustration, Fig. 16, shows a device perfected in the Institute laboratory whereby all of the quantities embodied in thickness measurements are under control. The usual thickness gauge was dismantled and the coiled spring on the presser foot was removed. In place of this a small duralumin scale-pan was placed on top of the sliding member. In this, weights of any desired amount may be placed. The sliding member was lapped so as to move with as little friction as possible. A protruding arm from the clockwork in the case beneath was arranged to lower the scale-pan and sliding member at the rate of 12 inches per minute. In this manner, a definite weight and rate of application were secured. The sliding member is raised by winding up the clockwork. Pressure upon the button in the foreground causes the presser foot to descend upon the fabric at a uniform and predetermined rate. The final weight of the presser foot may be that of the sliding member itself, or additional weights may be placed in the scale-pan. The readings on this instrument are taken 15 seconds after the presser foot stops moving. The apparatus is supported on a rigid base, so that vibration will not cause the foot to sink into the fabric. This device has proved very satisfactory in reading the thickness of many different types of fabric. In measuring the diameter of yarns, it is evident that a square presser foot should be used, so that a definite length of the yarn may be under the foot. When several strands are placed side by side, and the presser foot is round, the above is not always the case, and widely varying results are noted from such measurements.

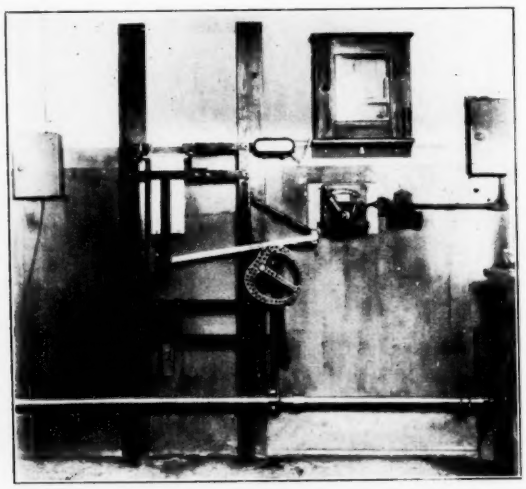


Fig. 17

Fig. 18

Most fabrics are set to resist abrasion in the use to which they are put. The future laboratory will always have some type of abrading apparatus which may be used at least to give comparative results between various types of goods. The question of the form of the abrasion machine is one which is yet under discussion.

(i) *Abrasion.* Fig. 17. It is quite necessary that some seven different variables should be standardized before any type of abrasion apparatus is accepted. These have been rehearsed before this committee in recent papers, and it is not necessary to enumerate them again. It is sufficient to say that if the character, speed and precision of a rocking abradent be standardized, very many of the machines at present in use will give results of sufficient uniformity for comparison. It is doubtful whether absolute units will ever be employed in regard to abrasion, but there is no reason why, with the present condition of such machines, the comparative qualities of many types of fabric may not readily be obtained.

Many fabrics are intended as insulators, to protect the body from heat and cold. Consequently, the measurement of heat flow through such fabrics is of the utmost importance.

(j) *Heat Flow.* Some twelve years ago the speaker made an extended series of studies upon heat flow through fabrics such as blankets, comforters and wraps. The form of the apparatus is shown upon the slide, Fig. 18. A 3-stage electric heater was used to bring 90 lbs. of water in a large copper tube to blood temperature. It was maintained at this temperature with great precision by means of a magnetic switch and thermostatic thermometer. The electrical energy necessary to keep the temperature at 98.8° F. in a cold chamber at a storage warehouse (33° F.) was measured by means of the usual volt-ammeter. In this manner, the radiations of heat through a wide variety of blankets, etc., were measured electrically. A pure wool blanket of exceptional character and price was taken as a basis, and all the other types of blankets passing down to a very thin inexpensive form were ratioed to it in comparison.

At the Atlantic City meeting last June, Mr. Freed-

man, of the staff of R. H. Macy Company, New York City, described a very interesting type of machine for measuring heat flow in fabrics, and it was noted at the time that the relative efficiency of cotton and wool blankets stood at the same percentage from his apparatus that it did from the speaker's some twelve years before. This simply shows that with precision and care, the flow of heat may be measured through any fabric. This is a very valuable item, and the textile laboratory of the future must be equipped for such measurements.

Certain materials—felts, raw fibers and carded stock—are frequently used as mattress materials. It is evident that the resilience or "come-back" on such materials is a prime essential.

(k) *Resilience.* The Federal Specifications Board has written a careful summary of the necessary measurements to establish resilience in mattress materials. This was attempted many years ago by Mr. Clarence Widney, of Chicago, and his "resiliometer" is doubtless familiar to various of the audience. In a simple and fairly precise way he measured the hysteresis curve for a variety of felts and resilient materials. To do this, the material was loaded through a certain range of pressures and was then unloaded in a precisely opposite ratio. If the material had been 100

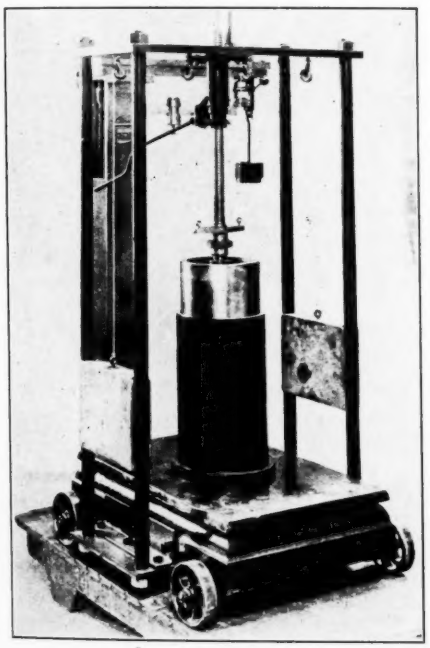


Fig. 19

per cent resilient, the downward and upward paths on the chart would have been superposed and the hysteresis arc would have been zero. In all known materials there is a certain element of lag which produces a definite hysteresis effect. The apparatus shown in the slide, Fig. 19, conforms to the requirements of the Federal Specifications Board. It consists of a screw-driven plunger with nicely graduated scale and vernier. The compressive force is simply weighed upon a pair of Fairbanks scales. After conditioning and weighing the material, the downward and upward paths will have somewhat the form shown upon the accompanying chart, Fig. 20. The area within this loop will measure the lag or lack of resilience which the material possesses.

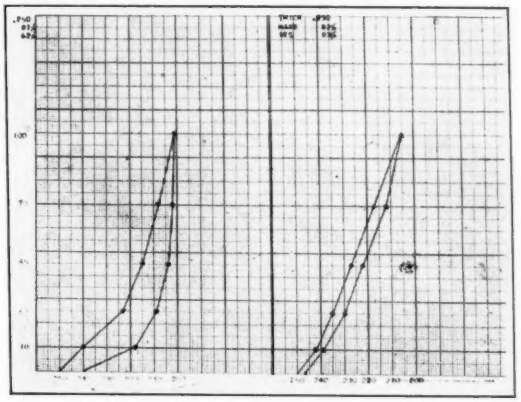


Fig. 20

The object of calling your attention to the above peculiar determinations has been not so much to explain the means by which the determinations have been made as to suggest a number of methods and applications whereby a wide variety of physical quantities may be recorded. The textile laboratory of the future will be able to handle not alone the simpler determinations but those of a highly complex nature. It is probable that the future demands in laboratories will transcend those of mechanical fabrics and will enter into the field of wearing apparel and all other textiles to whatever use they may be put. The laboratory man of the future should be equipped with a vast fund of expedients whereby he can measure easily and accurately all the varying physical quantities of textile materials.

New DuPont Dye

The Dyestuff Department of E. I. du Pont de Nemours & Company have placed on the market Pontacyl Fast Blue IB, an acid color yielding brilliant shades of navy blue on silk and wool.

This color is said to produce full shades on raw wool as well as on yarn and piece goods, and is particularly suitable for dark shoddy, both because of its brilliancy of shade and on account of the fact that when silk is present this is well covered. It is claimed that the product is a very suitable color both for the dyeing of pure and tin-weighted silk and when applied to these fibers possesses good fastness to hot moist pressing, perspiration, scrooping, steaming, water and washing. It may also be used for wool-silk mixtures and for combination materials where effect threads are desirable, as cotton is left white and rayon and cellulose acetate threads are only very slightly stained.

Klipstein Merged With Kalbfleisch

The assets and business of A. Klipstein & Company and its subsidiaries, chemical distributors, this city, have been purchased by the Kalbfleisch Corporation, a subsidiary of the American Cyanamid Co.

A. Klipstein & Co. is one of the leading concerns in the distribution of domestic and imported chemicals and is also a manufacturer of several chemical compositions for industrial use. It was founded in 1872. The company has extensive foreign connections and imports large quantities of industrial chemical materials. It has several branches in the United States and Canada. The dyestuffs branch of the business is an important one. This will probably be conducted in the future under the general direction of the Calco Chemical Company, manufacturer of synthetic dyes and intermediates, Bound Brook, N. J.

The business of A. Klipstein & Co., will be continued as a separate corporate entity.

Headquarters of the new company and those of the Kalbfleisch Corporation will be moved, January 1, to 535 Fifth Avenue.

Carbic Color and Chemical Co., Inc., agents of Durand & Huguenin S. A., announce Indigosol Violet ABBF, another member of the Indigosol range of especial interest for fast wool dyeing. The dyeings are said to have excellent fastness to light, washing and milling. Sol.-36.

Mr. A. H. Shafer has been recently appointed manager of The Foxboro Company's Pittsburgh Office, replacing Mr. H. S. Gray who is now in charge of office routine at the home plant.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED

Colorist, thirty, married, twelve years' experience in laboratory of dyestuff manufacturer, doing standardizing, shade matching, and demonstrating; desires position in dyestuff manufacturer's laboratory or in a mill. Address Classified Box No. 645, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Salesman, 12 years' selling experience dyestuffs, oils, finishes and specialties, 32 years of age, married. Familiar with Pennsylvania territory. Address: Classified Box No. 652, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

CHEMIST-EXECUTIVE AVAILABLE

Textile Chemist with twenty-two years' practical experience. Graduate Lowell Textile Institute. Four years instructor in Chemistry and Dyeing. Three years theoretical and practical experience in Peroxide Bleaching. Fifteen years in charge of chemical work in large textile plant. Experienced in purchase of dyes and chemicals. Excellent analyst, and one who can interpret results.

Would consider position as technical advisor to chemical or dyestuff executive. Address: Classified Box No. 638, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Dyer, Worsted and Woolen—technically trained man wishes to make a change about January 1st. Progressive and excellent color matcher. Has successfully managed several dye houses for a number of years, and can furnish excellent references confirming the above statement. Address Classified Box No. 644, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

PRINTER

Chemist-Colorist, 35 years of age, married, last 6 years Supervisor of Printing Establishment of one of the largest Eastern Plush Mills. Experienced in the printing of all colors on Mohair, Silk, Rayon and Cotton Plushes, also Brocaded Velvets and Soda Prints. Some Laboratory, Dyeing and Finishing experience. Will locate anywhere. Address: Classified Box No. 654, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

PRIVATE SECRETARY—ASSISTANT TO EXECUTIVE AVAILABLE

Private secretary, assistant to executive, with several years' experience with a foreign and domestic dyestuff and chemical manufacturing concern, desires a position in the above capacity. Address: Classified Box No. 651, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Rayon and cotton dyer, skeins, technical training, 10 years' exceptional experience. Put your dyehouse on paying basis. All types of dyes, perfect matches, fine winding. Best references. Address: Box No. 650, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.